Exhibit A

ANX® Release 1
Document Publication

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FOREWORD

Early in 1994, it was recognized at AIAG that there was a need for global network services that would support more new demanding automotive business applications. This network service needed to simplify complex, redundant, outdated connection methods while minimizing costs and ensuring the management, security, reliability and performance essential to the automotive industry.

In response to the need for a common protocol, Chrysler, Ford and General Motors endorsed TCP/IP as the standard suite for electronic data communications among Trading Partners. The AIAG publication "Trading Partner Data Telecommunications Protocol Position" JED-1 documented this position in late 1994.

In 1995, the Telecommunication Project Team was formed at AIAG to oversee the design and development of a common, global communication infrastructure supporting automotive industry application initiatives. Other Trading Partners joined the effort in 1996 forming the ANX Implementation Task Force.

In June 1997, the ANX Implementation Task Force, working with Bell Communications Research (Bellcore), various industry, Internet and government standards groups and representatives, published the "ANX Release 1 Draft Document Publication " (TEL-2 01.00). That publication contained the *initial* results of the technical design process for Release 1 of the Automotive Network eXchange (ANX).

This ANX Document is the first revision of the Draft Document Publication incorporating modifications to the processes, requirements, metrics and criteria defined in the Draft Document Publication and is the result of ongoing work by various participants as listed above, and the ANX pilot implementation.

This publication includes the following six main Parts:

- *Part 1 - ANX Certification Process for Service Providers*

- *Part 2 - ANX Certification Requirements for Service Providers*

- *Part 3 - ANX Registration and Subscription Process for Trading Partners*

- *Part 4 - ANX Overseer Services*

- *Part 5 - ANX Certificate Authority Service Provider Requirements*

- *Part 6 - ANX Trademarks, Glossary, and References*

The purpose of this ANX Document is to publish ANX specifications and requirements for ANX Release 1. This information was prepared for AIAG by Bellcore, with input and review provided by members of the ANX Implementation Task Force and ANX Pilot Stakeholders. This information should not necessarily be construed as the final word on ANX design. Corrections will occur as required and planned revisions may occur in the future. The success of the ANX Network Service relies on continuously improved definitions of user requirements and their appropriate standards-based solutions.

For ANX Service Providers, this ANX Document contains ANX design specifications and certification requirements. Potential use of the information by Network Service Providers and Exchange Point Operators is summarized in Parts 1, 2, and 6 of the document. Potential use of the information contained in this publication by Certificate Authority (CA) Service Providers is summarized in Parts 1, 5 and 6. Part 4 describes the ANX Overseer services.

For ANX Trading Partners, Part 3 of this ANX Document describes the ANX Registration and Subscription process. This publication should also be useful to Trading Partners who wish to align their Corporate Intranets with ANX service quality parameters as appropriate. Note, however, that the ANX does not require or provide for certification of Automotive Trading Partner's corporate network environment(s).

CONTINUOUS IMPROVEMENT

The ANX Network Service and the ANX specifications and processes described in this document will be continuously improved via comments, corrections and future revisions. See Part 4 (ANX Overseer services) for information on how to provide input to this process.

QUESTIONS

Questions and requests for proceeding with ANX Registration and Subscription services for Trading Partners and ANX Certification Services for Service Providers should be answered by the Frequently Asked Questions (FAQ) document at the ANXO public web site (http://www.anxo.com). Further requests may be directed to the ANXO Help Desk, at the telephone number announced on the same web site.

CORRECTIONS

Any corrections to this ANX Document will appear on the ANXO public web site (http://www.anxo.com).

ACKNOWLEDGMENTS

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This ANX Document was developed by Bellcore, under a consulting contract to the AIAG. We wish to acknowledge Bellcore's technical guidance, and the extraordinary efforts of Bryan Whittle, Bellcore ANXO General Manager, and all other Bellcore staff that contributed to the timely completion of this work. We also wish to acknowledge the dedication and effort of the following AIAG Telecommunications Project Team - ANX Implementation Task Force members, whose companies provided resource and financial support, and whose representatives provided substantial insight, input and revisions to this publication and other significant deliverables toward the ANX effort:

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PART 1

ANX Certification Process for Service Providers

Part 1 - ANX Certification Process for Service Providers

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1. ANX Certification

1.1 Scope of the ANX Certification

In general, certification is a process that determines the performance of an entity as measured by a specific set of ANX Certification Criteria. Automotive Network eXchange® (ANX®) Certification is the responsibility of the ANX Overseer (ANXO). The ANX Certification process shall assess the service quality of (1) an Internet Protocol Service Provider (ISP) and (2) an Exchange Point Operator (EPO) with respect to a specific set of ANX Certification Criteria. The requirements for ANX Certification Criteria that must be met by an ISP and an EPO are specified in [Part 6, Ref. #2]. The Document [Part 6, Ref. #2] identifies which ANX Certification Criteria apply to an ISP and which ANX Certification Criteria apply to an EPO. The document is available from the AIAG to the general public for a fee. It is important to note that the ANX Certification process does not certify all aspects of an ISP/EPO, but rather only those explicitly addressed by the ANX Certification Criteria specified in [Part 6, Ref. #2].

The ANX Certification Criteria in [Part 6, Ref. #2] are classified into three sets: (1) ANX Certification Application Criteria, (2) ANX Certification Assessment Criteria, and (3) ANX Certification Verification Criteria. During the ANX Certification Application stage of the ANX Certification process, an ISP/EPO is qualified by verifying 100% compliance to the ANX Certification Application Criteria. During the ANX Certification Assessment stage of the ANX Certification process, an ISP/EPO is qualified by verifying 100% compliance to the ANX Certification Assessment Criteria. The ANX Certification Verification stage verifies the ISP/EPO compliance consistent with the ANX CSP/ANX CEPO reporting schedule and ANXO monitoring and auditing over time and requires 100% compliance to the ANX Certification Verification Criteria.

1.2 Scope of This Document

This document [Part 6, Ref. #1] describes the ANX Certification process and the enabling infrastructure of support functions.

This document [Part 6, Ref. #1] is organized according to the states that an ISP/EPO can have within the ANX Certification process plus the support functions required to support the ANX Certification process.

1.3 Summary of ANX Certification

Figure 1-1 highlights the basic steps of the process of ANX Certification, which includes: 1) ANXO Contracting, 2) ANX Registration, 3) ANX Certification Application, 4) ANX Certification Assessment, 5) ANX Certification Verification, 6) Trouble Resolution, 7) ANX Certification Probation, 8) ANX Certification Revocation, and 9) ANX Re-certification.
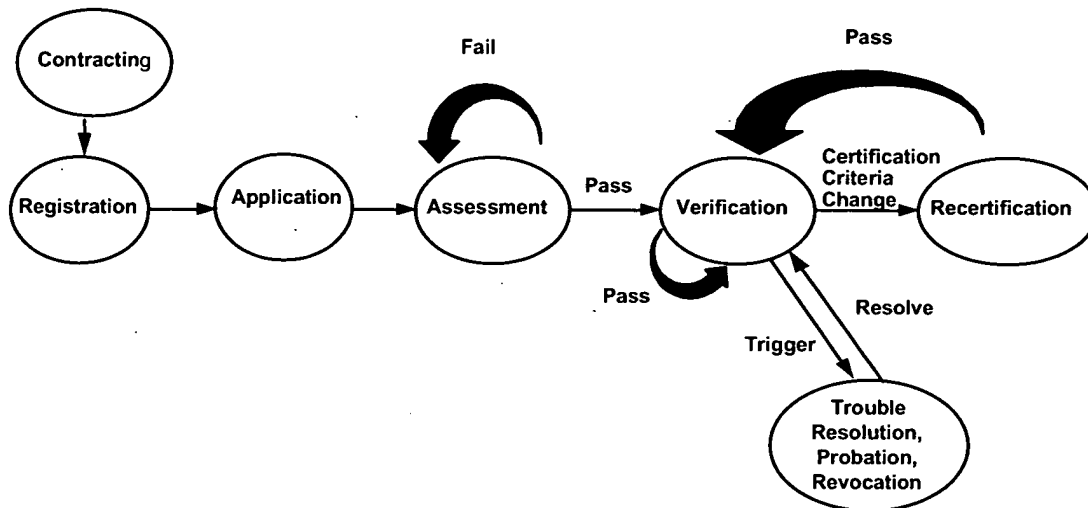
Figure 1-1. ANX Certification Process Summary

Details for the Trouble Resolution, ANX Certification Probation, and ANX Certification Revocation are shown in Figure 1-2. Following sections discuss each step of the ANX Certification process in detail.
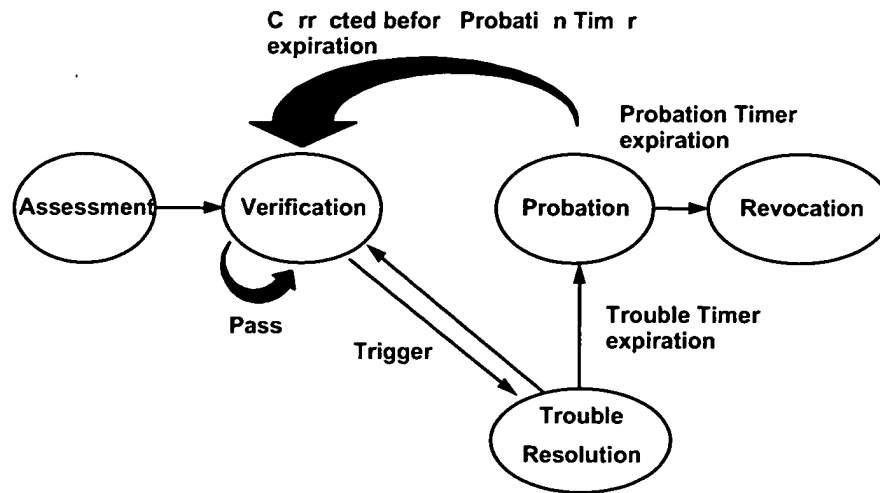
Figure 1-2. Expanded View of Trouble Resolution Process

1.4 ANX Certification States

During the process of ANX Certification, an ISP/EPO can be in one of eight states. These states, and transitions between them, are discussed in this document [Part 6, Ref. #1]. The eight (8) states are:

1. ANXO Contracted
2. ANX Registered
3. ANX Certification Assessment Pending
4. ANX Certification Assessment Withdrawn
5. ANX Certified - ANX Certification Type
6. ANX Certification Probation
7. ANX Certification Revoked
8. ANX Certification Verification Resigned

The Figure 1-3 below depicts these states and allowed transitions between them. The sections that elaborate the process definition for each state are shown.

ANXO Contracting for an ISP/EPO (Section 2)

ANX Registration for an ISP/EPO (Section 3)

Certification Application (Section 4)
Certification Assessment (Section 5)

Certification Verification (Section 6)
Trouble Handling (Section 7)
ReCertification (Section 10)

Trouble Handling (Section 7)
Certification Probation (Section 8)

Certification Revocation (Section 9)
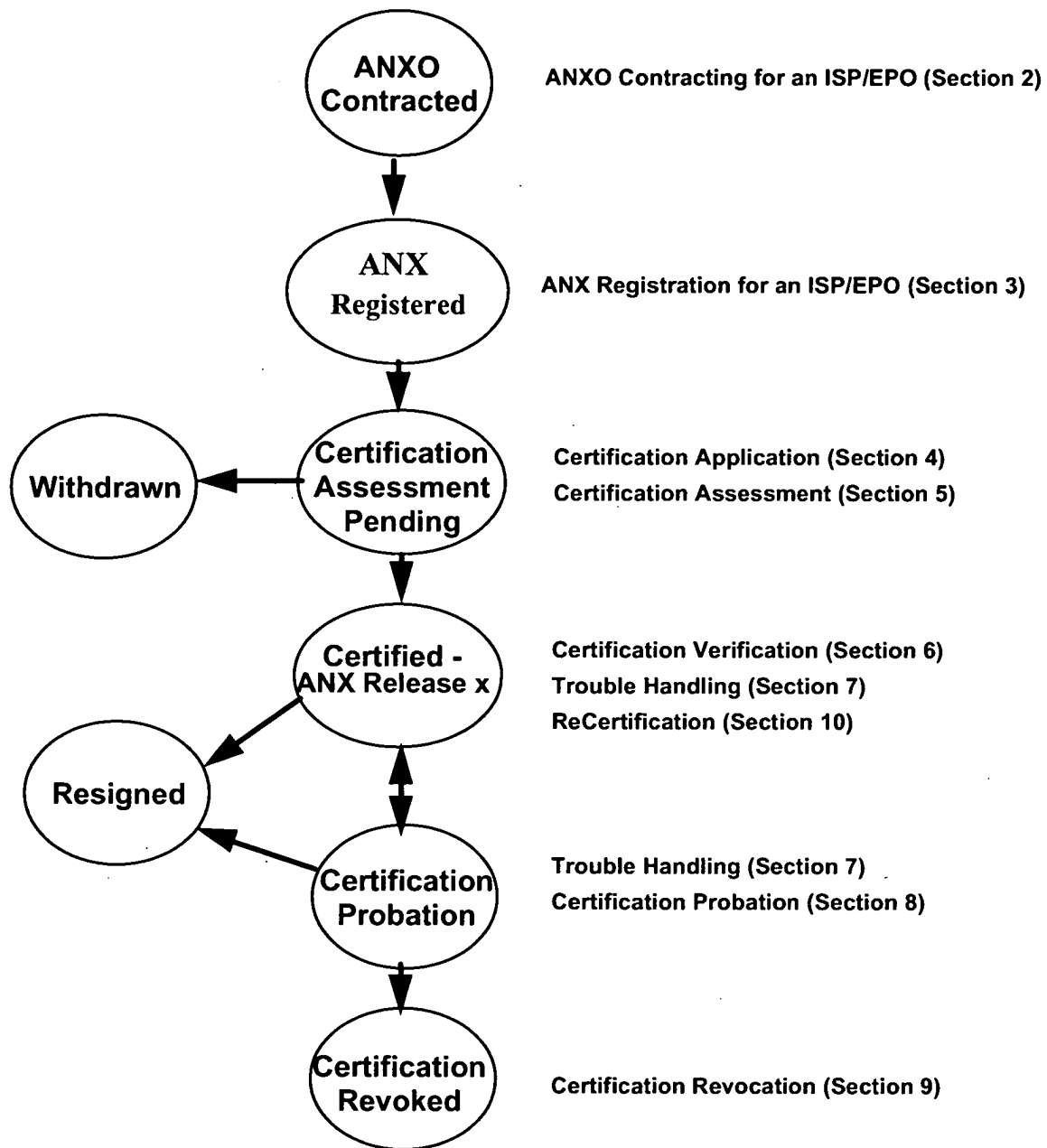
Figure 1-3. ISP/EPO States During Process of ANX Certification

1.5 ANXO Directory

The ANXO Directory provides state information for the ISPs/EPOs as they proceed through the process steps required for ANX Certification. The ANXO Directory divides the information based on (i) publicly visible information and (ii) information accessible only over the ANX Network. The URL for the website containing the public portion of the ANXO Directory is *http://www.anxo.com*. The URL for the ANX Network accessible portion of the ANXO Directory shall be given to each ANX CSP/ANX CEPO.

The Table 1-1 given below demonstrates this division of information.

ANX CERTIFICATION STATE	ANX NETWORK ACCESSIBLE PORTION OF ANXO DIRECTORY	PUBLIC PORTION OF ANXO DIRECTORY
ANXO Contracted	Yes	No
ANX Registered	Yes	No
ANX Certification Assessment Pending	Yes	Yes
ANX Certification Assessment Withdrawn	Yes	Yes
ANX Certified - ANX Certification Type	Yes	Yes
ANX Certification Probation	Yes	Yes
ANX Certification Revoked	Yes	Yes
ANX Certification Verification Resigned	Yes	Yes

Table 1-1. ANXO Directory

2. ANXO Contracting

The contract between the ANXO and an ISP/EPO is called an ANXO Contract for Service Providers.

2.1 ANXO Contracting Process

The ANXO Contracting process shall proceed as follows:

1. Service Provider obtains an ANXO Service Provisioning Package for Service Provider.
2. ANXO assigns an ANXO Contract Number. This ANXO Contract Number is to be used in initial correspondence with ANXO.
3. Service Provider signs each of two copies of the ANXO Contract for Service Provider and returns both to the ANXO.
4. ANXO signs both copies of the ANXO Contract for Service Provider and returns one to the Service Provider.

The ANX Registration phase can now begin.

2.2 ANXO Service Provisioning Package for Service Providers

The ANXO Service Provisioning Package shall be in English and includes:

1. Cover letter that includes instructions.
2. Two copies of ANXO Contract for Service Provider.
3. ANXO Contract for Service Providers Fee Schedule.
4. ANX Registration Form.
5. ANX Certification Application Form.

2.3 ANXO Contract for Service Providers Fee Schedule

The ANXO Contract for Service Providers Fee Schedule fees shall be billed by the ANXO. Billing shall include invoicing and collections. Certain characteristics of these fees are tabulated in the following Table 2-1.

FEE	HOW OFTEN?	WHEN PAID?	DESTINATION
ANX Certification Application	Once per Application	In advance of ANX Certification Application processing by ANX Overseer.	ANX Overseer
ANX Certification Assessment	Once per Assessment	In advance of ANX Certification Assessment processing by ANX Overseer. Hourly rate for any re-analysis due to initial failure of criteria.	ANX Overseer
ANX Certification Verification	Monthly	In advance per month. Time and materials in arrears for (1) trouble handling assistance beyond predefined limit, (2) facilitation of interconnection agreements.	ANX Overseer
ANX Re-Certification	Once per ANX Re-Certification - expected every 12-18 months	In advance of ANX Re-Certification processing by ANX Overseer. Hourly rate for any re-analysis due to initial failure of criteria.	ANX Overseer

Table 2-1. Fee Characteristics

The ANXO does not commence work on any aspect of the ANX Certification until payment is received. Therefore, the ANXO recommends that the Service Providers submit payment for their fees promptly to enhance the ability to timely complete the work associated with the ANX Certification process. For ANX Certification the payment may be submitted concurrently with each step of the process or it may be submitted for all process steps at the time of ANX Registration. If the Service Provider elects to submit payment for all process steps at the time of ANX Registration, the payment should consist of the following fees: (1) ANX Certification Application, (2) ANX Certification Assessment, and (3) First Monthly Fee for Certification Verification.

There are currently two methods for submission of fee payments: (1) payment by check at the time of application submission or (2) payment in response to invoice received from the ANXO. If payment via check is not provided at time of ANX Registration submission, the ANXO shall bill the Service Provider via use of an invoice directed to the billing contact.

2.4 ANXO Assigned Numbers

Initially, an ANXO Contract Number shall be assigned by the ANXO to each Service Provider with an ANXO Contract for Service Providers. The ANXO Contract Number is an unique number assigned by the ANXO to an ANXO Contract for Service Providers. The number is disclosed only to the contractual party.

Upon completion of the ANX Registration process, the Service Provider shall be assigned an ANXO Account Number. The ANXO Account Number shall be used in all communication with the ANXO.

The ANXO shall list each ANXO Account Number in the ANXO Directory against each listing of ISP/EPO state.

The format of this number is as follows:

SP-Z where Z = unique integer and being consecutively assigned starting at 0.

3. ANX Registration for an ISP/EPO

ANX Registration can be pursued by an ISP/EPO only when the company has a signed an ANXO Contract for Service Provider. An ISP/EPO does not need to be a member of the AIAG to become ANX Registered.

Successful completion of ANX Registration is required for the ANX Certification Application phase to begin.

3.1 ANX Registration Process

The ANX Registration process shall proceed as follows:

1. ISP/EPO completes the ANX Registration Form in the ANXO Service Provisioning Package for Service Providers.

2. ISP/EPO returns the ANX Registration Form.

3. ANXO analyses the ANX Registration Form.

4. ANXO sends notification of ANX Registration complete via letter to the ISP/EPO . The notification letter informs the Service Provider of their ANXO Account Number. The ANXO Account Number and the ANXO Contract Number are used to identify a Service Provider. The notification letter is sent within ten (10) business days of ANXO beginning of work.

Following successful completion of the ANX Registration the ANX Certification Application phase can now begin.

A publicly accessible web page (*http://www.anxo.com*), in English, shall be provided by the ANXO for frequently asked questions concerning the ANX Registration process.

4. ANX Certification Application

ANX Certification Application can be pursued by an ISP/EPO only when the company has completed ANX Registration and is in the ANX Registered state.

Successful completion of the ANX Certification Application phase is required for the ANX Certification Assessment phase to begin.

4.1 ANX Certification Application Process

The ANX Certification Application process shall proceed as follows:

1. ISP/EPO completes the ANX Certification Application Form in the ANXO Service Provisioning Package for Service Providers.

2. ISP/EPO returns the ANX Certification Application Form.

3. Concurrently with step 2 above, the ISP/EPO can send a check completed as shown on the ANXO public web site; otherwise ANXO invoices ISP/EPO for the ANX Certification Application Fee.. The ANX Certification Application Fee is described in Section 2.3.

4. The ANXO shall verify that the ISP/EPO successfully completed ANX Registration. If not the ANXO shall complete the ANX Registration prior to proceeding with ANX Certification Application processing.

5. ANXO validates the payment.

6. ANXO analyses the Certification Application Form for compliance with the ANX Certification Application Criteria in [Part 6, Ref. #2].

7. ANXO sends an ANX Certification Application Report to the ISP/EPO with status Pass or Fail within twenty (20) business days of ANXO beginning of work. If Fail then the ISP/EPO can return to step 1 above.

5. ANX Certification Assessment

ANX Certification Assessment can be pursued by an ISP/EPO only when the company has successfully completed ANX Certification Application. ANX Certification Assessment evaluates the ability of the ISP/EPO Network to met the requirements stated in ANX Release 1, for North America. ANX Release 2 is expected to require reevaluation with respect to incremental criteria.

Successful completion of the ANX Certification Assessment phase is required for the ANX Certification Verification phase to begin.

5.1 ANX Certification Assessment Process

The ANX Certification Assessment process proceeds as described below.

1. ISP/EPO can send a check completed as shown on the ANXO public web site; otherwise ANXO invoices ISP/EPO for the ANX Certification Assessment Fee. The ANX Certification Assessment Fee is described in Section 2.3.

2. ANX Certification Assessment Kickoff Meeting. The ANXO shall host a half day meeting with the ISP/EPO. The meeting will be held at the ANXO location. This is an opportunity for the ANXO and the ISP/EPO to personally meet and discuss the ANX Certification Assessment process and needed information. Questions can be answered and logistics arranged to facilitate the ANX Certification Assessment. The calendar dates of Business Days One, $X > 30$, $Y \geq X + 25$, $90 \geq Z > Y$, and One Hundred And Twenty of ANX Certification Assessment will be agreed upon.

3. Business Day One. ANX Certification Assessment begins. An ISP/EPO shall be analyzed by the ANXO to determine compliance with the ANX Certification Assessment Criteria specified in [Part 6, Ref. #2]. This ANX Certification Assessment is objective and repeatable for any ISP/EPO that is assessed. An ISP/EPO shall meet all the ANX Certification Assessment Criteria with 100% compliance in order to Pass.

   There are two stages to ANX Certification Assessment, namely Part A and the subsequent Part B. Part A concerns those ANX Certification Assessment requirements specified in [Part 6, Ref. #2] which can be analyzed without connection to the ANX Network; Part B concerns those ANX Certification Assessment requirements specified in [Part 6, Ref. #2] which require connection to the ANX Network. ANX Certification Assessment Part A has a maximum duration of one hundred and twenty (120) business days starting at Business Day One and excluding Public Holidays. The ANX Certification Assessment Timer is set to this maximum.

4. Business Day Twenty. Deadline for submission of ISP/EPO ANX Certification Assessment data to be analyzed for the First ANX Certification Assessment Report.

5. <u>Business Day Thirty.</u> Deadline for First ANX Certification Assessment Report to be issued by ANXO. This report shall indicate for each ANX Certification Assessment Criterion for Part A whether (1) the ISP/EPO has submitted all data required by ANXO, or (2) if not then an identification of what is missing. This report shall be sent by Postal Mail with receipt confirmation to the ISP/EPO for review and comment.

6. <u>Business Day X > Thirty.</u> Deadline for ISP/EPO response to the First ANX Certification Assessment Report is due back to ANXO.

7. <u>Business Day Y ≥ X + 25</u> Second ANX Certification Assessment Report issued by ANXO. This report shall be sent by Postal Mail with receipt confirmation to the ISP/EPO for review and comment.

   A Second ANX Certification Assessment Report can result in one of two possible outcomes:

   • An ISP/EPO can Pass the ANX Certification Assessment. This enables the ISP/EPO to move into the ANX Certification Assessment Part B phase.

   • An ISP/EPO can Fail the ANX Certification Assessment. The ISP/EPO shall be given the opportunity to either (1) correct the non-compliance, or (2) withdraw from ANX Certification Assessment.

8. <u>Business Day Z, where 90 ≥ Z > Y.</u> Deadline for ISP/EPO submission of its corrections for non-compliance's to the ANXO. The ANXO shall re-analyze the areas of deficiency for a time and materials fee identified in Table 2-1 in Section 2.3 above. The ANXO shall determine whether the ISP/EPO meets all the ANX Certification Assessment Part A Criteria with 100% compliance. Otherwise, the ISP/EPO is deemed by the ANXO to Fail the ANX Certification Assessment and the ISP/EPO requires a complete new ANX Certification Assessment by returning to step 1 of this Section.

   During the period of removal of non-compliance, the ISP/EPO shall remain in the ANX Certification Assessment Pending state in the ANXO Directory.

9. <u>Business Day One Hundred And Twenty.</u> Deadline for Third ANX Certification Assessment Report. After taking the ISP/EPO comments into consideration, and re-analyzing if necessary, the ANXO shall make a final determination of Pass or Fail. The ANXO shall deliver its Pass/Fail determination in a Third ANX Certification Assessment Report. The issuing of this report marks the ending time of the ANX Certification Assessment Timer. This report shall be sent by Postal Mail with receipt confirmation to the ISP/EPO for review and comment.

10. <u>Fourth ANX Certification Assessment Report.</u> The ANXO shall then analyze the ANX Certification Assessment Part B requirements. These relate to the ISP/EPO connecting to the ANX Network, ANX peering establishment, ANXO interface testing, and EPO backup link testing. These results will be combined with the Third ANX Certification Assessment Report into the Fourth ANX Certification Assessment Report which is the

permanent record of the ANX Certification Assessment and shall be archived in the ANXO Documentation Repository. There is no specific duration for Part B because of variability in the ANX Network connect time.

5.2 Awarding ANX Certification

There are two prerequisites for awarding ANX Certification:

1. Passing the ANX Certification Assessment.

2. Paid first month's fee to the ANXO for ANX Certification Verification.

Then the incoming ANX CSP/ANX CEPO can submit ANX Routes to the ANX Routing Registry so as to establish ANX Peering with existing ANX CSPs/ANX CEPOs as required by ANX Certification Verification requirements in [Part 6, Ref. #2].

The ANXO shall then provide the ANX CSP/ANX CEPO with:

- Letter of Approval.

- Certificate of ANX Certification stating the ANX Certification Type of the ANX Certification of the ISP/EPO Network , e.g., ANX Release 1, North America.

- List as ANX Certified in the ANXO Directory

5.3 Waivers

There are no Waivers allowed in the ANX Certification Assessment process.

5.4 ANX Certification Assessment Withdrawn State

ANX Certification Assessment Withdrawn is a state assigned to an ISP/EPO to allow for withdrawal from the ANX Certification Assessment process when the ISP/EPO is in the ANX Certification Assessment Pending state. The entrance into the ANX Certification Assessment Withdrawn state is self initiated by the ISP/EPO. The ISP indicates its desire to enter this state through the submission of a written notification to the ANXO. Its state is then marked as ANX Certification Assessment Withdrawn in the ANXO Directory.

If an ISP/EPO withdraws from the ANX Certification Assessment process during the ANX Certification Assessment Pending state, and wishes to reapply at a later time, it will be required to repeat the ANX Certification Application process from the beginning.

ANX Certification Assessment Withdrawn state does not describe the state where an ANX CSP/CEPO wishes to withdraw from providing ANX Service. Such a state is described as ANX Certification Verification Resigned state as explained in the following Section 6.2.

6. ANX Certification Verification

ANX Certification Verification can be pursued by an ISP/EPO only when such ISP/EPO has been awarded ANX Certification. The ANX CSP is allowed to provide ANX Service to TPs and an ANX CEPO is allowed to provide ANX Network Services as defined in [Part 6, Ref. #2] to ANX CSPs. The ongoing process of ANX Certification Verification shall commence. An ANX CSP/ANX CEPO shall be analyzed by the ANXO to determine compliance with the ANX Certification Verification Criteria specified in [Part 6, Ref. #2]. The ANX CSP/ANX CEPO shall meet all ANX Certification Verification Criteria with 100% compliance. If any ANX Certification Verification Criterion is not met, the ANXO trouble handling process would be initiated - the ANXO would issue a trouble ticket and start the Trouble Timer for the maximum time allowed to be in the trouble resolution state.

An illustration for ANX Certification Verification is displayed in Section 1.3.

6.1 ANX Certification Verification Process

The ANX Certification Verification process proceeds as described below.

6.1.1 Types of ANX Certification Verification Measurements

The ANXO shall monitor ANX CSP/ANX CEPOs for continued compliance to the ANX Certification Verification Criteria specified in [Part 6, Ref. #2]. The ANXO shall use two types of ANX Certification Verification measurements:

- ANX Certification Verification data shall be gathered by the ANXO on a regular basis as defined in [Part 6, Ref. #2]. The ANXO shall evaluate this data against the ANX Certification Verification Criteria.

- The ANXO shall also conduct ANX Certification Verification Audits of ANX CSP/ANX CEPOs and evaluate this data against ANX Certification Verification Criteria. ANX Certification Verification Audits can be performed at random intervals or be event driven.

6.1.2 Initiation of the ANXO Trouble Handling

ANX CSP/ANX CEPO failure to met any ANX Certification Verification Criterion immediately initiates the ANXO Trouble Handling process.

6.1.3 Tripwire Metrics

With respect to ANX Certification Verification, selected metrics have been identified in [Part 6, Ref. #2] as Tripwire Metrics. Tripwires are distinguished as indicators of especially severe service quality degradation that require immediate and vigorous corrective action and require a strict limit on the duration of the degradation. If any ANX Certification Verification Criterion is not met for a Tripwire Metric, a Waiver shall not be granted during the trouble handling process.

6.1.4 Triggers for Event Driven ANX Certification Verification Audits

Triggers for ANX Certification Verification Audits of an ANX CSP/ANX CEPO are the following:

- Non-compliance with terms and conditions of ANXO Contract for Service Providers.

- ANX CSP/ANX CEPO notification to the ANXO of any significant changes that may affect their ANX Certification state as required by the terms and conditions of the ANXO Contract for Service Provider.

6.1.5 Waivers

There are no Waivers allowed in the ANX Certification Verification process except in so far as the ANXO Trouble Handling process provides for waivers as discussed below.

6.2 ANX Certification Verification Resigned State

This is a state assigned to an ANX CSP/CEPO. The assignment of this state can occur anytime after the ISP/EPO has been ANX Certified and established ANX Peering in the ANX Network. Once ANX Peering is established, the ANX CSP/CEPO is assumed to be providing ANX Services.

Resignation from providing ANX Services and entrance into the ANX Certification Verification Resigned state is self initiated by the ANX CSP/CEPO. The ANX CSP/CEPO indicates its desire to enter this state through the submission of a written notification to the ANXO. Its state is then marked as ANX Certification Verification Resigned in the ANXO Directory.

The ANX CSP/ANX CEPO shall continue to provide ANX Service for 150 calendar days from the time of ANXO acknowledgment of receipt of notification of Resignation.

At the end of this 150 calendar days, the ANXO Contract is terminated.

7. Trouble Handling

7.1 Trouble Escalation Model

Figure 7-1 below illustrates the escalation sequence for ANX Subscribed TP related and Service Provider related problems.

For example, consider a trouble detected by an ANX Subscribed TP. The steps shall be as follows:

1. The ANX Subscribed TP shall determine if it is a TP-to-TP trouble, in which case it is to be handled outside the scope of ANX Network, or an ANX Subscribed TP to ANX Network trouble.

2. If it is an ANX Subscribed TP to ANX Network trouble and if the resolution cannot be obtained within the ANX Subscribed TP, then the trouble shall be escalated with the relevant data to the ANX CSP, following an arrow numbered 2 in Figure 7-1. It is expected that ANX Subscribed TPs will escalate to their ANX CSP rather than directly to the ANXO as illustrated by arrows numbered 5.

3. The ANX CSP and ANX Subscribed TP groups shall try to resolve the problem.

   If the trouble involves other ANX CSP/ANX CEPOs the ANX CSP shall coordinate between the involved ANX CSP/ANX CEPOs, following arrows numbered 3 in the Figure 7-1.

4. If all the involved ANX CSP/ANX CEPOs cannot resolve the trouble, then the ANX CSP to whom the ANX Subscribed TP subscribes shall escalate it to the ANXO, along with the trouble ticket with all the trouble history to date. Every other ANX CSP/CEPO involved shall also submit trouble ticket information to the ANXO. If this information is not made available, the ANXO shall request that it be provided. This follows arrows numbered 4 in Figure 7-1.

5. The ANXO shall initiate the ANXO Trouble Handling process for the trouble.
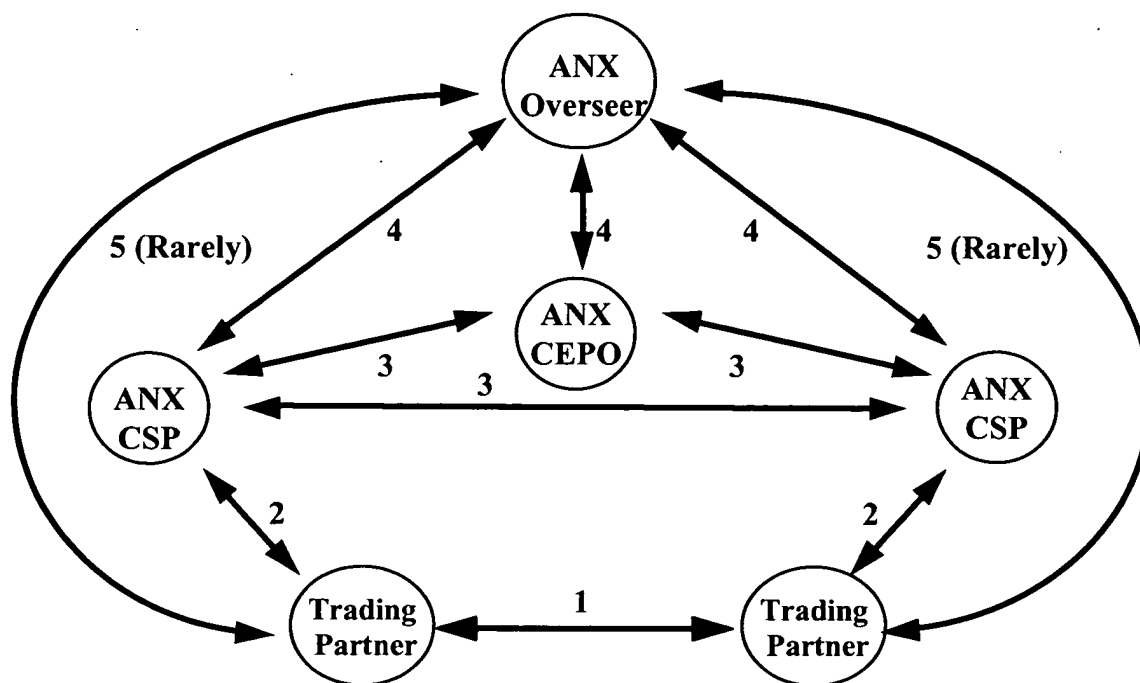
Figure 7-1: ANX Trouble Escalation Model

7.1.1 Requirements on ANX CSP/ANX CEPO

Escalation shall be done to the ANXO when the ANX CSP/ANX CEPO fails to resolve a trouble after implementing the other procedures in its Trouble Escalation Policy as defined in [Part 6, Ref. #2]. The ANXO shall function as a problem resolution focal point, aiding in the determination of the problem, isolation of problems, and in the definition of action plans for resolutions. Correction is the responsibility of the ANX CSP/ANX CEPOs.

If the ANXO inspection of the trouble history submitted by ANX CSPs and ANX CEPOs shows that the process steps prescribed above for ANX CSP/ANX CEPOs were not followed, the ANXO shall initiate the trouble handling process for the ANX CSP/ANX CEPO itself because the ANX CSP/ANX CEPO has not met the required ANX Certification Verification Criterion for Trouble Handling and Escalation Policy as described in [Part 6, Ref. #2].

7.1.2 Expectations on Trading Partners

It is expected that ANX Subscribed TPs work with the ANX CSP to which they subscribe and through the trouble handling process of that ANX CSP before escalating to the ANXO for resolution. When an ANX Subscribed TP calls the ANXO, as illustrated by arrows numbered 5 in the Figure above, the ANXO shall notify the ANX CSP and work with the ANX CSP as if the trouble had been reported by the ANX CSP.

7.1.3 ANXO Trouble Handling

The ANXO Trouble Handling process proceeds as described below.

7.1.4 Triggers

The ANXO Trouble Handling process is initiated by the following triggers:

- ANXO measured non-compliance to a ANX Certification Verification Criterion as determined by the measurement types described above in Section 6.1.1.

- A help desk report by an ANX CSP or ANX CEPO to escalate an unresolvable trouble.

- A help desk report by an ANX Subscribed TP which has exhausted trouble resolution procedures with its ANX CSP.

- ANXO detects ANX CSP/ANX CEPO failure to comply with contractual terms and conditions.

- The onset of ANX CSP/ANX CEPO business insolvency, e.g., as evidenced by a Chapter 11 filing.

- ANX Re-certification Timer expires.

7.1.5 ANXO Actions

For each initiation of the trouble resolution process, the ANXO shall:

1. Open an ANXO Trouble Ticket.

2. Start and monitor a thirty (30) calendar day Trouble Timer.

3. For an ANX CSP/ANX CEPO reported trouble, obtain trouble ticket(s) from each ANX CSP/ANX CEPO involved with the trouble history to date. If this information is not made available, the ANXO shall request that it be provided.

4. If the ANXO inspection of the trouble history shows that the process steps described above were not followed, the ANXO shall initiate the trouble handling process for the ANX CSP itself.

5. Assign a Trouble Severity to the ANXO Trouble Ticket.

6. If the trouble represents a distributed problem that involves several entities to correct, the ANXO shall determine which entity is responsible and accountable to correct the trouble, allocate the problems and resolution actions, and formally notify the parties. The ANXO shall annotate the ANXO Trouble Ticket with these results.

7. In the course of resolution of a trouble, a Waiver can be requested by the ANX CSP/ANX CEPO. This is discussed in Section 7.2 "Waiver" below. If a Waiver is granted, the Trouble Timer duration is incremented by the amount determined by the Waiver.

8. If the Trouble Timer expires, the ANX CSP/CEPO is deemed to be on ANX Certification Probation. The trouble resolution continues until the trouble is resolved.

9. When the trouble is resolved, all associated ANX CSP/ANX CEPO trouble tickets shall be closed and the ANXO notified of their closure. Care needs to be taken to close all appropriate trouble tickets, so as not to clutter the trouble process with irrelevant tickets.

10. The ANXO Trouble Ticket is closed with an explanation of the outcome.

11. The Trouble Timer, or ANX Certification Probation Timer, is stopped.

No notification of any trouble shall be made other than as described by the Inter-ANX CSP Outage Notification requirements in [Part 6, Ref. #2].

7.1.6 Trouble Severity Classifications

ANXO Trouble Severity classifications are defined in [Part 6, Ref. #2]. This is to ensure alignment of the ANXO trouble handling priorities and ANXO Trouble Severity codes with ANX CSPs/ANX CEPOs in order that sharing of trouble tickets be most effective and in order to sustain the TP-centric design of the trouble resolution process. As necessary, the ANXO shall give higher priority in urgency to a higher class trouble.

Refer to [Part 6, Ref. #2] for the descriptions of five classes of ANXO Trouble Tickets.

7.2 Waivers

If any ANX Certification Verification Criterion is not met for a Tripwire Metric, a Waiver shall not be granted during the ANXO trouble handling process.

If any ANX Certification Verification Criterion is not met for a metric that is not a Tripwire Metric, under special conditions a Waiver can be granted so as to extend the Trouble Timer beyond thirty (30) calendar days. A Waiver can provide for a one time extension to the Trouble Timer - no further extension shall be granted.

A Waiver Application shall be submitted to the ANXO. It shall state:

- The duration of the requested extension to the Trouble Timer.

- The justification for the Waiver.

- How this duration time period is commensurate with the driving requirement. For example, if an ANX CSP/ANX CEPO requires delivery of a T1 from the local carrier in order to resolve a trouble, and if the lead time can be demonstrated to exceed the 30 day window, then a Waiver can reasonably be granted for the incremental time required.

The ANXO shall document its assessment of the impacts and the possible resulting risks of the Waiver in an ANXO Waiver Evaluation. The ANXO shall approve or deny the Waiver Application during the lifetime of the Trouble Timer, and communicate this result to the ANX CSP/ANX CEPO within a specified time, indicated by value of the Waiver Application Reply Timer. The value of the Waiver Application Reply Timer is 14 calendar days so as to allow the ANX CSP/ANX CEPO to communicate any required evidence in support of the Waiver Application to the ANXO.

If the ANXO disapproves a Waiver Application, the ANX CSP/ANX CEPO can choose to invoke the Appeal Process described in Section 11.1 below.

7.3 ANXO Trouble Handling Fees

Beyond a limit of hours per ANX CSP/ANX CEPO as defined in [Part 6, Ref. #1], the ANXO support for trouble resolution shall result in additional fees being levied by the ANXO on the ANX CSP/ANX CEPO. See Section 2.3 above.

8. ANX Certification Probation

ANX Certification Probation is intended to address serious service quality concerns. ANX Certification Probation is not intended to be used frequently.

8.1 ANX Certification Probation Process

ANX Certification Probation process defined here is illustrated in Figure 1-2 in Section 1.3.

8.1.1 Triggers

There is one possible cause of ANX Certification Probation: Expiration of the Trouble Timer in the Trouble Resolution state, if a resolution cannot be reached.

8.1.2 ANXO Actions

8.1.2.1 Repetitive ANX Certification Probation

The ANXO shall determine when the ANX CSP/ANX CEPO has had the state of ANX Certification Probation before. If the ANX CSP/ANX CEPO has had that state already twice within any contiguous twelve (12) month period during which the present case arises, the ANXO shall invoke the ANX Certification Revocation process. Otherwise the ANX Certification Probation process proceeds as described below.

8.1.2.2 ANX Certification Probation Timer

Once on ANX Certification Probation, the ANXO shall start and monitor a ANX Certification Probation Timer of sixty (60) calendar days. If the problems are not corrected in a timely fashion, then the ANXO deems the ANX CSP/ANX CEPO state as ANX Certification Revoked.

8.1.2.3 Monitor No Signing up New TPs

The ANX CSP/ANX CEPO shall not sign up any new TPs while in the ANX Certification Probation state. If this occurs and becomes known to the ANXO during the period of ANX Certification Probation, then the ANXO deems the ANX CSP/ANX CEPO state as ANX Certification Revoked.

8.1.2.4 Waivers

There are no Waivers allowed in the ANX Certification Probation process.

8.1.2.5 ANXO Directory

The ANXO shall list the state of the ANX CSP/ANX CEPO as ANX Certification Probation in the ANXO Directory. The ANX Certification Probation Timer expiration date shall also be recorded. In addition the ANXO shall summarize the cause for ANX Certification Probation so as to provide TPs with a basis on which to evaluate the severity of the problem; if the cause concerns not meeting a Tripwire Metric Criterion that shall be noted.

8.1.2.6 Written Notification

The ANXO shall notify the ANX Subscribed Trading Partners of the ANX Certification Probation state of the ANX CSP with which they are subscribed.

9. ANX Certification Revocation

ANX Certification Revocation is intended to address chronic or repetitive serious service quality concerns. ANX Certification Revocation is not intended to be used frequently. It can cause significant costs for the TPs which must migrate to another ANX CSP or the ANX CSPs which must migrate to another ANX CEPO in order to maintain business continuity. TP to ANX CSP and ANX CSP to ANX CEPO contracts may have stipulations about actions needed in the case of ANX Certification Revocation for an ANX CSP/ANX CEPO. A TP is expected to migrate to another ANX CSP, and an ANX CSP is expected to migrate to other interconnection arrangements with ANX CSPs, within the 90 calendar day period.

An illustration for ANX Certification Revocation is displayed in Section 1.3.

9.1 ANX Certification Revocation Process

9.1.1 Triggers

There are two possible causes of ANX Certification Revocation:

- Expiration of the ANX Certification Probation Timer.

- Expiration of Trouble Timer within the same twelve (12) month period during which the ANX CSP/ANX CEPO has had two ANX Certification Probation's.

9.1.2 ANXO Actions

9.1.2.1 ANX Certification Revocation Timer

Once on ANX Certification Revocation, the ANXO shall start and monitor a ANX Certification Revocation Timer of ninety (90) calendar days.

9.1.2.2 ANXO Directory

The ANXO shall record the state of the ANX CSP/ANX CEPO as ANX Certification Revoked in the ANXO Directory. The ANX Certification Revocation Timer expiration date shall also be recorded. In addition the ANXO shall summarize the cause for ANX Certification Revocation.

9.1.2.3 Written Notification

The ANXO shall notify the ANX CSP/ANX CEPO in writing by Postal Mail with receipt confirmation of their ANX Certification Revoked state.

The ANXO shall notify ANX Subscribed Trading Partners of the ANX Certification Revocation state of the ANX CSP with which they are subscribed.

9.1.2.4 Deletion of ANX Routes from ANX Routing Registry

At the conclusion of the 90 calendar days, the ANXO shall delete the ANX Routes for the ANX CSP from the ANX Routing Registry.

9.1.2.5 Waivers

There are no Waivers allowed in the ANX Certification Revocation process.

10. ANX Re-Certification

10.1 ANX Re-Certification Process

The main purpose of ANX Re-Certification is for compliance with incremental requirements in a new ANX Release. When a new ANX Release of ANX Certification Criteria is published, each existing ANX CSP/ANX CEPO shall need to be recertified by the ANXO to verify 100% compliance to the new ANX Certification Criteria. Releases are expected to be made no more than once a year.

The process for ANX Re-certification is the same as the ANX Certification Assessment process with a more directed ANX Certification Criteria set. The relevant ANX Certification Criteria shall be specified in documentation available from the AIAG to the general public for a fee.

The ANX CSP/ANX CEPO shall be responsible for its ANX Re-certification, whatever the trigger for ANX Re-certification.

The ANX CSP/ANX CEPO shall schedule ANX Re-certification within a specific time frame from availability of the new set of ANX Certification Criteria. The specific time frame shall be identified by the ANXO when the ANX Certification Criteria are published. The time frame shall be commensurate with the magnitude of the change in ANX Certification Criteria from the previous ANX Release. By requiring a specific time frame, all ANX CSP/ANX CEPOs shall progress upward in their service quality in a uniform fashion and time frame. Once the ANX Certification Criteria are published, the ANXO shall start and monitor a ANX Re-certification Timer.

After the ANX Re-certification Timer has expired for an ANX CSP/ANX CEPO, the ANXO shall initiate the ANX Trouble Handling process.

10.1.1 ANX Re-certification Timer

At least thirty (30) business days in advance, the ANXO shall notify by Postal Mail with receipt confirmation each ANX CSP/ANX CEPO as to the calendar date that will initiate the period of ANX Re-certification. On that date, the ANXO shall start and monitor an ANX Re-certification Timer of sixty (60) calendar days.

10.1.2 ANX Re-certification Fees

ANX Re-certification shall be priced according to the extent of the needed services from the ANXO. This is the case regardless of the trigger for ANX Re-certification.

11. Dispute Resolution

11.1 Appeal Process

The Appeal process is established to provide a check and balance with respect to the ANXO making fair and well judged decisions. A company can Appeal at any time.

The Appeal process proceeds as follows:

1. An Appeal shall be made initially to the ANXO. Each Appeal shall be in writing.

2. The ANXO shall make no change in the state of the ANXO Directory of an ISP/EPO or ANX CSP/ANX CEPO which is in Appeal. The ANXO shall review the Appeal and shall either (1) reconfirm the decision, or (2) change the decision. This outcome shall be communicated in writing by the ANXO to the company making the Appeal and to the AIAG, or AIAG designated body. This shall be done in twenty five (25) U.S. business days from date of appeal.

3. If the ANXO reconfirms the decision that is being Appealed, or if the Appeal is not in relation to an ANXO decision, the AIAG, or AIAG designated body, shall review the Appeal and the explanation of and related ANXO decision. In relation to an ANXO decision, the AIAG shall either (1) reconfirm the decision, or (2) change the decision. The outcome shall be communicated in writing by the AIAG, or AIAG designated body, to the company making the Appeal and to the ANXO. This shall be done in twenty five (25) U.S. business days from date of ANXO reconfirmation of decision.

4. If necessary, the dispute shall enter an arbitration phase discussed below.

11.1.1 Arbitration

Any controversy or claim arising out of or related to this Agreement, or the breach thereof, which is not resolved pursuant to the Appeals Process shall be resolved by binding arbitration by a single arbitrator in accordance with the Commercial Arbitration Rules of the American Arbitration Association, and judgment upon the award rendered by the arbitrator may be entered in any court having jurisdiction thereof. The arbitrator shall be an individual with substantial experience at the senior management level with a company engaged in the computer technology and telecommunications industries. The arbitrator shall be bound by the terms, conditions and remedies provided for herein, and shall have no authority to impose penalties or award punitive damages. The arbitration shall take place in New Jersey, and the arbitrator shall apply Michigan law. The initial costs of any arbitration shall be shared respectively by the parties, however, upon award of any judgment or conclusion of arbitration, the arbitrator shall award the prevailing party the costs it expended in such arbitration. Unless the arbitrator otherwise directs, the parties, their representatives, other participants and the arbitrator shall hold the existence, content and result of arbitration in confidence.

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11.2 Facilitation of Interconnection Agreements

Timely business agreements concerning ANX CSP and ANX CEPO interconnection is important to the evolution of ANX Release 1. These interconnection agreements concern the exchange of traffic among ANX CSPs at ANX CEPOs and at bilateral connection points. The ANXO shall assist in resolving business disputes concerning these interconnection agreements. Requests for such assistance are to be submitted in writing, with explanation, to the ANXO.

Per Section 2.3 above the ANXO shall charge the parties involved a fee, based on time and materials, to effect this facilitation.

12. Appendix A: Candidate Enhancements Beyond ANX Release 1

1. The ANX Registration Package shall be in English for ANX Release 1. When translation is necessary in the future, this shall be accommodated.

2. The ANX Certification Application package shall be in English for ANX Release 1. When translation is necessary in the future, this shall be accommodated.

3. Selected ANX Certification Criteria are expected to be modified for international use. ANX Certification Criteria may need to be specialized based on governmental regulatory constraints and differing country policies.

PART 2

ANX Certification Requirements for Service Providers

TEL-2 02.00, 5/1998

Part 2 - ANX Certification Requirements for Service Providers

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1. Introduction

1.1 Scope of This Document

This Part 2 document specifies requirements for an Internet Service Provider (ISP), Exchange Point Operator (EPO), or other data communications service provider, to become and to sustain its status as an Automotive Network eXchange® Certified Internet Service Provider (ANX® CSP)[1] or an Automotive Network eXchange Certified Exchange Point Operator (ANX CEPO)[1] only for the ANX Network Service they provide to the ANX Subscribed Trading Partners and only for the portion of their networks that they have architected to provide the ANX Network Service. The ANX Certification process that is the context for these requirements is described in [Part 6, Ref #1]. The material in this document should be read in conjunction with [Part 6, Ref #1].

Any corrections to this Part 2 of the ANX Document will appear on the public ANXO web site.

This document describes:

- ANX Certification Application requirements for Service Providers;
- ANX Certification Assessment and ANX Certification Verification requirements for Service Providers; and
- ANXO interfacing requirements for Service Providers.

As the basis for these requirements, this document specifies metrics, i.e., measurable attributes of Service Quality. The scope of these metrics is to cover those aspects of ISP and EPO Service Quality that affect whether or not ANX Release 1 meets the business requirements of automotive industry Trading Partner (TP) applications such as CAD, EDI, database access, e-mail, and groupware.

The metrics specified in this document are at the Internet Protocol (IP) level or lower levels. This document does not specify application level metrics for IP applications.

ANX Certification Application requirements are specified in Section 1.

The ANX Certification Assessment and ANX Certification Verification requirements for Service Quality are organized into the following eight (8) categories and are elaborated in the Sections of this document as shown below:

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[1] Automotive Network eXchange ® and ANX® are registered U.S. service marks of the AIAG.

1.   Network Service Metrics - Section 2

2.   Interoperability Metrics - Section 3

3.   Performance Metrics - Section 3

4.   Reliability Metrics - Section 4

5.   Business Continuity and Disaster Recovery Metrics - Section 6

6.   Security Metrics - Section 7

7.   Customer Care / Help Desk Metrics - Section 8

8.   Trouble Handling Metrics - Section 9

ANXO interfacing requirements are provided in Section 10.

1.2 Approach to Requirements

1.2.1 Terminology

This Section introduces some key terms that are used in this document.

1.2.1.1 *Metric and Criterion for a Metric*

A **metric** is defined to be a measurable attribute of <u>ANX CSP/ANX CEPO</u> Service Quality.

A **Criterion for a metric** is defined to be the allowed quantitative range of values of a metric.

1.2.1.2 *Measurement Technique and Criterion for a Measurement Technique*

Measurement Technique for a metric refers to the process used to gather and analyze measurement data so the ANXO can determine whether the Criterion defined for that metric is satisfied.

For each metric stated in this document, there are Measurement Technique requirements that ISPs/EPOs who apply for ANX Certification Assessment (i.e. ANX CSP/ANX CEPO Applicants) must comply with. There are also Measurement Technique requirements for each metric that an ANX CSP/ANX CEPO must comply with on an ongoing basis and report to the ANXO periodically or if any changes occur as stated specifically for each metric in this document.

A **Criterion for a Measurement Technique** is defined to be the allowed range of values for the content and timing of measurements submitted by an ISP/EPO or an ANX CSP/ANX CEPO to the ANXO.

The following Measurement Techniques apply for ANX Certification Verification - see Table 1-1.

Type of Data	ANX CSP/ANX CEPO Action	ANXO Action
Type 1: Policies, Compliance statements, etc.	Provides evidence periodically to ANXO or when changes occur	(1) Verifies compliance of provided data. (2) Audits and verifies compliance.
Type 2: Continuous statistics	Gathers statistics. Provides statistics periodically to ANXO.	(1) Verifies compliance of supplied statistics. (2) Audits and verifies compliance.
Type 3: Continuous statistics	Does not provide statistics to the ANXO.	ANXO takes measurements and verifies compliance.

Table 1-1: Measurement Techniques and Actions

1.2.1.3 Requirement

A **requirement** is defined to be a feature or function that is necessary to be satisfied by an ISP/EPO or ANX CSP/ANX CEPO. A requirement contains the word "shall" and is marked with an "R" in the margin. Requirements are organized in **Numbered Requirement Packages**. The numbering format is as follows (x corresponds to a main section number: and y denotes a sequence number):

1. **[Rx-y: CertApp]** for ANX Certification Application requirements

2. **[Rx-y: CertAss]** for ANX Certification Assessment requirements

3. **[Rx-y: CertVer]** for ANX Certification Verification requirements

A summary of the requirements follows at the end of each main section using the numbered requirement packages.

1.3 ANX Certification Application Requirements

ANX Subscribed Trading Partners would incur significant cost and disruption to their business activities if a service provider fails to sustain service quality. The purpose of this application is to reduce the possibility of a disruption by certifying only those service providers that have a proven track record as a business as well as in dealing with business customers, and have the

ability, the resources and the financial stability to provide consistent quality of services now as well as in the foreseeable future.

[R1-1.: CertApp]   Company Information

R   The ANX CSP/ANX CEPO Applicant **shall** provide all of the following company information as part of the ANX Certification Application requirements:

1. Name and address of the company/ subsidiary (and the name and address of the parent company if it is a subsidiary) that will provide ANX Network Service.

2. ANXO Service Contract number.

3. Date and state of incorporation.

4. Corporate credit rating of the ANX CSP/ ANX CEPO Applicant or parent (if ANX CSP/ ANX CEPO Applicant is a subsidiary)

5. Information on structure and control of company (public, private (partnership, proprietorship), subsidiary, joint venture or other association of service providers, or other).

6. Major shareholders (if subsidiary of another company, please provide name and address of parent company).

7. Information on its main line of business (Internet service provider, custom network provider, Internet backbone provider, Internet exchange point provider, local aggregator, IXC, ILEC, CLEC, or other). The ANX CSP/ANX CEPO Applicant **shall** elaborate on its main line of business.

8. Number of years the ANX CSP/ ANX CEPO Applicant/ parent has been in business. If under different names, the ANX CSP/ ANX CEPO Applicant **shall** indicate former names. The ANX CSP/ ANX CEPO Applicant **shall** represent that it has been in business for at least three years.

9. Number of years the company has been an Internet Network Service Provider or Internet Exchange Point Provider (provider of Internet access (dialup and/or dedicated), Internet backbone services, Internet Exchange Point Services, or provider of custom data networks, IP networking services, etc.). The ANX CSP/ANX CEPO Applicant **shall** represent that it has been a provider of one or more of the above services for at least two years.

[R1-2.: CertApp]   Employees

R   The ANX CSP/ANX CEPO Applicant **shall** indicate number of employees by function, and **shall** describe the function of employees anticipated to provide the ANX Network Service. The

ANX CSP/ANX CEPO Applicant **shall** describe its commitment to providing these staffing levels described.

[R1-3.: CertApp]   Products and Services

R   The ANX CSP/ANX CEPO Applicant **shall** describe its primary products and services and **shall** explain how its primary products and services are similar to the ANX Network Service.

[R1-4.: CertApp]   Experience with Business Customers

R   The ANX CSP/ANX CEPO Applicant **shall** provide the following information regarding its experience with business customers:

1. The ANX CSP/ANX CEPO Applicant **shall** indicate the number of years it has provided Internet access/Internet backbone/Internet Exchange Point/custom data networking/IP networking services to business customers. ANX CSP/ANX CEPO Applicant **shall** represent that it has provided one or more of these services to business customers for at least one year.

2. The ANX CSP/ANX CEPO Applicant **shall** indicate the number of business customers it has had for at least a year.

3. The ANX CSP/ANX CEPO Applicant **shall** indicate the percentage of parent's revenues that are ANX CSP/ANX CEPO Applicant revenues.

4. The ANX CSP/ANX CEPO Applicant **shall** represent that it has a customer retention rate of at least 75% for the past two fiscal years.

5. The ANX CSP/ANX CEPO Applicant **shall** represent that it does not derive more than 35% of revenues from a single customer, unless the ANX CSP/ANX CEPO Applicant has long-term agreement with this customer or the ANX CSP/ANX CEPO Applicant can demonstrate that it **shall** remain financially stable and **shall** be able to provide required ANX Network Service if it were to lose this single customer.

[R1-5.: CertApp]   Management Experience

R   The ANX CSP/ANX CEPO Applicant **shall** provide information on its management team's experience in running ANX CSP/ANX CEPO Applicant or similar businesses:

- The ANX CSP/ANX CEPO Applicant **shall** describe background and experience of its primary and backup contacts and attach their biography data.

[R1-6.: CertApp]   Technical Experience

R   The ANX CSP/ANX CEPO Applicant **shall** indicate number of years of IP networking/Internet Exchange operations/security and other related technical experience of its technical staff.

[R1-7.: CertApp]   Commitment to Providing ANX Network Service

R   The ANX CSP/ANX CEPO Applicant **shall** comply with all of the following:

1. The ANX CSP/ANX CEPO Applicant **shall** demonstrate the extent to which financial and other resources are being committed by the parent company or principal(s) to the entity that will be providing the ANX Network Service

2. In the event of any mergers and acquisitions or any corporate restructuring, the ANX CSP/ANX CEPO Applicant **shall** represent that there will be no impact on providing ANX Network Service.

3. The ANX CSP/ANX CEPO Applicant **shall** indicate willingness to sign a service-level agreement for required components and services indicated in Part 1 [Part 6, Ref #1] and Part2 of the ANX Document.

4. The ANX CSP/ANX CEPO Applicant **shall** indicate if any single customer that made up more than 5% of Applicant's revenues has moved to a competitor and **shall** provide information on when and why it happened.

[R1-8.: CertApp]   Future Business Plans

R   The ANX CSP/ANX CEPO Applicant **shall** provide forward-looking information as described below, unless it is demonstrated that the ANX CSP/ANX CEPO Applicant and its customers will have recourse to funding and resources of the ANX CSP/ANX CEPO Applicant's parent organization, and if the ANX CSP/ANX CEPO Applicant's parent organization has a Moody's (or equivalent) corporate credit rating of "A" and above:

1. The ANX CSP/ANX CEPO Applicant **shall** provide information on its near-term business plans (current fiscal year) and longer-term business plans (two (2) fiscal years after current fiscal year) and **shall** provide all necessary documentation.   Provided business plans **shall** include, but **shall** not be limited to, information on:

    a)   target markets,

    b)   service and product offerings planned,

    c)   expected revenues and growth rates,

    d)   distribution channels for company's products and services,

    e)   action plans to achieve objectives, and

    f)   funding plans

2. In case of funding from another organization, the ANX CSP/ANX CEPO Applicant **shall** indicate relationship of the funding organization to the ANX CSP/ANX CEPO Applicant, and the funding organization's main line of business, its last FY revenues, net income,

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cash flow from operating activities and free cash flow (defined in the following financial metrics requirements).

[R1-9.: CertApp]   Financial Metrics (in US Dollars)

R The ANX CSP/ANX CEPO Applicant **shall** provide <u>forward-looking</u> information, unless it is demonstrated that the ANX CSP/ANX CEPO Applicant and its customers will have recourse to funding and resources of the ANX CSP/ANX CEPO Applicant's parent organization, and if the ANX CSP/ANX CEPO Applicant's parent organization has a Moody's (or equivalent) corporate credit rating of "A" and above:

1. The financial information provided, as described herein, **shall** be certified by an external auditor or a Certified Public Accountant (CPA) from within the ANX CSP/ANX CEPO Applicant's organization.

2. The ANX CSP/ANX CEPO Applicant **shall** state when its fiscal year ends.

3. The ANX CSP/ANX CEPO Applicant (referred to as the "Applicant" in the following tables) **shall** comply with all the requirements stated in the following tables.

	Last Fiscal YR	FY Prior to Last
# of business customers at FY-end		
Profit & Loss (P&L) (of Parent company, if different from Applicant)		
Net revenues ($K)	Parent/ Applicant revenues shall be at least $25M	
Revenues from business customers ($K)	At least 25% of Parent/ Applicant revenues shall be derived from business customers	
% of Parent/ Applicant net revenues attributable to Applicant		
Cost of revenue (includes depreciation & amortization) ($K)		
Selling, general & administration ($K)		
EBITDA (Earnings before interest, taxes, depreciation & amortization) ($K)		
Depreciation ($K)		
Amortization ($K)		
Taxes ($K)		
Net income ($K)		
Cash Flow (of Parent company, if different from Applicant)		
Change in working capital, source/ (use) of cash, ($K)		
Cash flow from operating activities (Net income + non-cash expenses (depreciation & amortization) + source (- use) of funding from working capital) ($K)	If negative, cash flow shall be an improvement/ stable from last FY	
Capital expenditure ($K)		
Dividends ($K)		
Free cash flow (Cash flow from operating activities - capital expenditures) ($K)		

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Projections

	Current FY	Next FY	FY after next
# of business customers at FY-end			
P&L (of Parent company, if different from Applicant)			
Net revenues ($K)	Revenues **shall** be greater than last FY	Revenues **shall** be greater than last FY	
Revenues from business customers ($K)	At least 25% of Parent/ Applicant revenues **shall** be derived from business customers	At least 25% of Parent/ Applicant revenues **shall** be derived from business customers	
% of Parent/Applicant revenues attributable to Applicant (including ANX Network Services)			
Cost of revenue (includes depreciation & amortization) ($K)			
Selling, general & administration ($K)			
EBITDA (Earnings before interest, taxes, depreciation, amortization) ($K)			
Depreciation ($K)			
Amortization ($K)			
Taxes ($K)			
Net income ($K)			
Cash Flow (of Parent company, if different from Applicant)			
Change in working capital, source/ (use) of cash, ($K)			
Cash flow from operating activities (Net income + non-cash expenses (depreciation & amortization) + source (- use) of funding from working capital) ($K)	If negative, cash flow **shall** be an improvement/ stable from last FY	If negative, cash flow **shall** be an improvement/ stable from last FY	
Capital expenditure ($K)			
Dividends ($K)			
Free cash flow (Cash flow from operating activities - capital expenditures ($K)			

4. If cash flow from operating activities is negative, the ANX CSP/ANX CEPO Applicant **shall** indicate how it plans to fund its operations and for how long. The ANX CSP/ANX CEPO Applicant **shall** also indicate when it expects cash flow from operating activities to become positive.

5. The ANX CSP/ANX CEPO Applicant **shall** indicate that it will have resources in place to fund its operating activities while providing ANX Network Service.

Ratio Analysis (of Parent company, if different from Applicant)

Liquidity Ratios

	End of last FY	End of FY prior to last
Current Ratio (current assets/ current liabilities)	rent/ Applicant shall have a ratio of at least 0.9, unless company has a Moody's (or equivalent) corporate credit rating of "A" or better	
Cash Ratio (cash & marketable securities/ current liabilities)		
Receivables Turnover (net annual sales/ average receivables)		

Projections

	End of current FY	End of next FY
Current Ratio (current assets/ current liabilities)	arent/ Applicant shall have a ratio of at least 0.9, unless company has a Moody's (or equivalent) corporate credit rating of "A" or better	arent/ Applicant shall have a ratio of at least 0.9, unless company has a Moody's (or equivalent) corporate credit rating of "A" or better
Cash Ratio (cash & marketable securities/ current liabilities)		
Receivables Turnover (net annual sales/ average receivables)		

Performance Ratios

	End of last FY	End of FY prior to last
Net fixed asset turnover ratio (net sales/ average net fixed assets)		
Earnings before interest, tax & depreciation/ net sales		

Projections

	End of current FY	End of next FY
Net fixed asset turnover ratio (net sales/ average net fixed assets)		
Earnings before interest, tax & depreciation/ net sales		

Financial Risk Ratios

(Exclude deferred taxes as long-term debt; Include capital leases; Provide information on operating leases; Use book values for debt and equity)

	End of last FY	End of FY prior to last
tal long term debt/ (Total long term debt + Total Equity)		
tal debt (current & long-term)/ (Total debt + total equity)	t/ Applicant **shall** have a ratio of at most 0.5	
sh flow from operating activities/ Interest expense	gative, Parent/ Applicant **shall** have improving/ stable ratio from last FY	
sh flow from operating activities/ long-term debt	gative, Parent/ Applicant **shall** have improving/ stable ratio from last FY	
sh flow from operating activities/ total debt	gative, Parent/ Applicant **shall** have improving/ stable ratio from last FY	

Projections

	End of current FY	End of next FY
tal long term debt/ (Total long term debt + Total Equity)		
tal debt (current & long-term)/ (Total debt + total equity)	arent/ Applicant **shall** have a ratio of at most 0.5	rent/ Applicant **shall** have a ratio of at most 0.5
sh flow from operating activities/ Interest expense	negative, Parent/ Applicant **shall** have improving/ stable ratio from last FY	negative, Parent/ Applicant **shall** have improving/ stable ratio from last FY
sh flow from operating activities/ long-term debt	negative, Parent/ Applicant **shall** have improving/ stable ratio from last FY	negative, Parent/ Applicant **shall** have improving/ stable ratio from last FY
sh flow from operating activities/ total debt	negative, Parent/ Applicant **shall** have improving/ stable ratio from last FY	negative, Parent/ Applicant **shall** have improving/ stable ratio from last FY

[R1-10.: CertApp]   Legal Metrics

Potential conflicts of interest in operating as an ANX CSP and ANX CEPO

R   ANX CSP/ANX CEPO Applicant **shall** attach letter from Applicant's Counsel indicating that it does not have any and does not anticipate any conflicts of interest.

Pending litigation

R   ANX CSP/ANX CEPO Applicant **shall** attach letter from Applicant's Counsel indicating that it does not have any pending litigation that could impact applicant's ability to serve as a reputable ANX Certified Service Provider.

[R1-11.: CertApp] Insurance Metrics

Liability insurance coverage

R   ANX CSP/ANX CEPO Applicant **shall** list its insurance carrier, and **shall** indicate its coverages and limitations. ANX CSP/ANX CEPO Applicant **shall** have at least the following coverages (in US$):

1. general liability : $2.0M,

2. products - comp/ op aggregate : $2.0M,

3. personal and advertising injury : $1.0M,

4. each occurrence : $1.0M,

5. fire damage (any one fire) : $1.0M,

6. medical expense (any one person) : $25K

[R1-12.: CertApp] Trigger

R   If, after receiving ANX Certification, the ANX CSP/ANX CEPO Applicant fails to meet required financial criteria (including credit rating), it **shall** notify ANXO immediately. In addition, ANX CSP/ANX CEPO **shall** inform the ANXO of its plans to remedy the situation, and **shall** inform the ANXO on its progress every quarter until it meets the required financial criteria again.

[R1-13.: CertApp] Supporting Documentation

R   ANX CSP/ANX CEPO Applicant **shall** attach the following additional supporting documentation:

1. Annual reports for last 3 fiscal years. If not available, please explain why and provide certified financial reports showing Profit & Loss, Balance Sheet and Cash Flows for last 3 fiscal years.

2. Report from a credit agency such as Dun & Bradstreet, Moody's, etc.

3. A list of reference business customers and letters of recommendation from at least three major relevant business customers.

4. Biography data of ANX CSP/ANX CEPO Applicant's primary point of contact and back-up contact.

[R1-14.: CertApp] Format of All Submitted Documentation

R   The ANX CSP/ANX CEPO Applicant **shall** provide ANXO ANX Certification Application documentation in hard copy or in PDF format, on 3.5" floppy or Iomega-compatible zip drive.

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An Applicant for certification that fails to conform in the minimum required manner to one or more of the criteria set forth in this ANX Certification Application Requirements section may demonstrate to the ANXO why it would nonetheless be able to provide a consistent quality of ANX Network Service.

1.4 ANX Certification Assessment and ANX Certification Verification Requirements

ANX Certification Assessment requirements refer to those requirements necessary to be met by an ISP/EPO to become eligible to be certified under ANX Release 1. Based on the ANX Certification Assessment requirements defined in this document, an ISP/EPO will be analyzed to determine conformance. An ISP/EPO, i.e. an ANX CSP/ANX CEPO Applicant, must meet all requirements with 100% compliance. A determination of pass or fail is made. Upon passing the assessment, the ISP/EPO will then be provided with the contract for the ongoing process of ANX Certification Verification; when this contract is signed, the ISP/EPO is an ANX CSP/ANX CEPO.

In [Part 6, Ref #1], two parts in the ANX Certification Assessment process are distinguished:

1.   Part A: Those ANX Certification Assessment criteria that do not require a connection to the ANX Network

2.   Part B: Those ANX Certification Assessment criteria that do require a connection to the ANX Network

The metrics corresponding to these Parts A and B are as shown in Table 1-2.

ANX Certification Assessment Process Parts	ANX Certification Assessment Criteria
Part B	1) Establishment of Peering for New ANX CSP Applicants 2) Connectivity with the ANXO 3) Participation in ANX Route Service 4) Participation in ANX-enabled Domain Name Service 5) ANXO Performance Testing Interface 6) Participation in ANXO Trouble Handling Service 7) Support of ANX Certificate Based IPSec Communications with ANXO
Part A	8) All Other ANX Certification Assessment Criteria

Table 1-2: ANX Certification Assessment Criteria Parts A and B

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ANX Certification Verification requirements refer to those requirements necessary to be met by an ANX CSP/ANX CEPO to remain certified under ANX Release 1. Based on the ANX Certification Verification requirements defined in this document an ANX CSP/ANX CEPO will be analyzed to determine conformance. An ANX CSP/ANX CEPO must meet all requirements with 100% compliance.

The ANXO may conduct **audits** of ANX CSP/ANX CEPOs for conformance to ANX Certification Assessment and ANX Certification Verification Criteria. Audits may be performed randomly or event driven.

1.4.1 ANX Certification Verification Tripwire Metrics

With respect to ANX Certification Verification, nine (9) metrics have been defined as Tripwire Metrics. Tripwire Metrics are listed in Table 1-3. If the Criterion for a Tripwire Metric is not met, that would immediately initiate the ANXO trouble resolution process, including starting the timer for the maximum time allowed to be in the trouble resolution state. If this timer expires the ANX CSP/ANX CEPO transitions to a state of probation [Part 6, Ref #1].

This distinction of a subset of ANX Certification Verification requirements is not to contradict the necessity for all other requirements to be met for ANX Certification Verification. Not meeting any one of those requirements also initiates the ANXO trouble resolution process, including starting the timer for the maximum time allowed to be in the trouble resolution state.

Service Quality Category	Tripwire Metric
Performance	Throughput
	Packet Loss
	Network Edge-to-Edge Packet Latency
	File Transfer Delay
Reliability	ANX CSP Overall Network Availability
	Total Network Outage Events
Business Continuity and Disaster Recovery	Business Continuity and Disaster Recovery Plan
Trouble Handling	Trouble Response Time
	Trouble Handling and Escalation Policy

Table 1-3: Tripwire Metrics

Tripwire Metrics are distinguished as indicators of especially severe Service Quality degradation that require immediate and vigorous corrective action and require a strict limit on the duration of the degradation. Thus during ANXO trouble handling, waivers would not be granted.

Requirements for tripwire metrics are elaborated in the Section of this document that corresponds to the Service Quality category shown.

1.4.2 Reporting Format

Reporting format refers to the document/template format to be used in reporting metrics data by the ISP/EPO at ANX Certification Assessment, and by the ANX CSP/ANX CEPO at ANX Certification Verification. Required reporting format for each metric is identified in the metrics summary tables in the document.

1.4.3 Design Principles for Metrics Definitions

ANX Certification Assessment and ANX Verification Requirements are specified in this document for Criteria for metrics and Criteria for Measurement Techniques.

1.4.3.1 TP Perspective

Consistent with the AIAG Implementation Task Force (ITF) mandate that ANX Network Service has a TP-Centric design, this document focuses on an ANX Subscribed Trading Partner (TP) perspective of ANX CSP/ANX CEPO requirements. In particular, metrics and Criteria are chosen to:

- Match the business process requirements of ANX Subscribed TPs. Service quality provided by the ANX infrastructure should be adequate to support the business processes, and corresponding applications, with the most stringent requirements.

- Support a broad range of applications and application protocols required by the ANX Subscribed TPs. These were reviewed in a confidential activity detailing the current state of automotive networks and applications environments. The application types include CAD file transfer; EDI file transfer; terminal access to CAD files, EDI files and databases; e-mail, and groupware. From this list we can determine that the requirements imposed on the network infrastructure are not limited to a small set of specific application load characteristics or traffic mix. For this reason, the set of metrics and Criteria enumerated in this document are not limited to support of a specialized application mix.

  ANX Release 1 does not contain requirements to support applications that transmit real-time video or audio (isochronous traffic), or multipoint or multicast applications such as collaborative CAD. However, the requirements in this document may be modified in future releases to be extensible to such a broader application profile.

- Have a broad scope concerning ANX Subscribed TP Service Quality needs, spanning (1) network services, (2) interoperability, (3) performance, (4) reliability, (5) business continuity and disaster recovery, (6) security, (7) customer care, and (8) trouble handling.

- Match ANX Subscribed TP expectations based on today's network use, including state of the practice IP VPN service levels. Publicly available, and privately communicated, service level measurements have been taken into account in determining the Criteria in this document.

- Apply to each ANX CSP/ANX CEPO supporting an ANX Subscribed TP to ANX Subscribed TP communication so as to support the engineering of an "edge-to-edge" Service Quality across ANX Release 1 that is consistent and predictable regardless of which service providers are involved.

1.4.3.2 ANX CSP/ANX CEPO Perspective

Metrics and Criteria are chosen that:

- They are deemed feasible for multiple ISPs and EPOs to implement in the ANX Release 1 time frame. An evaluation of service provider current service levels and directions has been taken into account in determining the Criteria in this document.

- They apply to multiple connectivity scenarios. For many metrics, three scenarios shown in Figure 1-1, can be distinguished in the definition of detailed requirements:

ANX Subscribed TP —(ANX CSP)— ANX Subscribed TP

Single ANX CSP Scenario

ANX Subscribed TP—(ANX CSP(a))—(ANX CSP(b))—ANX Subscribed TP

Multi-ANX CSP Scenario

ANX Subscribed TP—(ANX CSP(a))—(ANX CEPO)—(ANX CSP(b))—ANX Subscribed TP

ANX CEPO Scenario
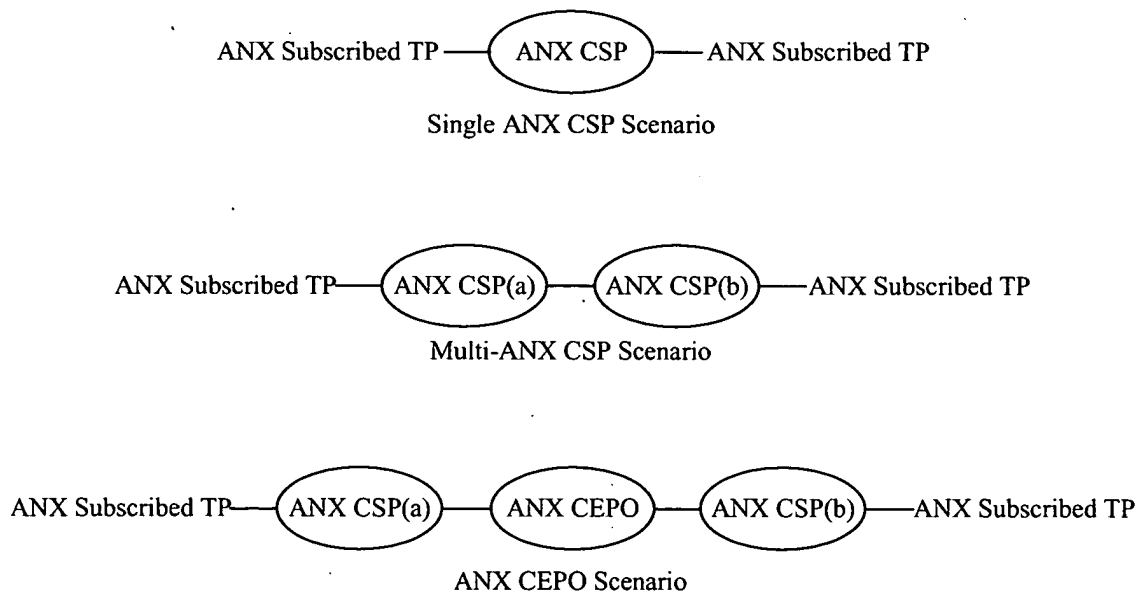
Figure 1-1: Metrics Applicability

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- ANX Certification measurements done by the ANXO or by the ANX CSP/ANX CEPO are not to degrade ANX CSP/ANX CEPO Service Quality. The ANXO measurements are designed not to cause Service Quality degradation, e.g., a single performance test generates traffic patterns similar to a single application which the ANX Network Service normally supports.

- There is impartiality with respect to ISPs, ANX CSPs, EPOs and ANX CEPOs. The design philosophy behind the selection of metrics is to not favor architecture of any particular ISP/EPO, set of ISP/EPOs, or any type of equipment used in ISP/EPO networks, or any particular equipment manufacturer, to the extent possible.

1.4.4 Industry Perspective

The ANX Certification requirements in this document generally conform to the initial guidelines set by the Internet Protocol Performance Metrics (IPPM) Working Group of the IETF [7]. These guidelines are stated as follows:

1. The metrics must be concrete and well-defined.

2. A methodology for a metric should have the property that it is repeatable: if the methodology is used multiple times under identical conditions, the same measurements should yield the same results.

3. The metrics must exhibit no bias for IP clouds implemented with identical technology.

4. The metrics must exhibit understood and fair bias for IP clouds implemented with non-identical technology.

5. The metrics must be useful to users and providers in understanding the performance they experience or provide.

6. The metrics must avoid inducing artificial performance goals.

2. Network Service Metrics

2.1 Scope

Four ANX CSP network service categories are distinguished as shown in Table 2-1:

ANX CSP Network Service Categories	Subject to Certification	ANX CSP Action	TP Action
Basic Services	Yes	Must Provide	Must Select
ANX CSP-Required ANX Subscribed TP-Selectable Certified Services	Yes	Must Provide	Optional to Select or Decline
ANX CSP-Optional Certified Services	Yes	Optional	Optional
Other Value Added Services	No	Optional	Optional

Table 2-1: Four ANX CSP Service Categories

1. Basic Services: The ANX CSPs must provide the set of basic services to the ANX Subscribed TPs. ANX Subscribed TPs must select all of these basic ANX CSP services.

2. ANX CSP-Required ANX Subscribed TP-Selectable Certified Services: ANX CSPs are required to offer an additional set of services to ANX Subscribed TPs. Services in this category must be explicitly selected or explicitly declined by ANX Subscribed TPs (like the process used by car rental companies to have the customer select or decline options by initialing/signing). In the implementation of these services, ANX CSPs must adhere to the specific requirements listed in this document.

3. ANX CSP-Optional Certified Services: These can be offered by an ANX CSP at its discretion; if they are offered, the ANX CSP must then adhere to the specific requirements listed in this document.

4. Other Value Added Services: These are not subject to ANX Certification. However, any resulting network traffic and service processes must not degrade the Service Quality defined by the requirements listed in this document.

2.2 Approach and M thodology

The approach and methodology for ANX Certification Assessment and ANX Certification Verification of network services are:

1.   The ISP/ANX CSP provides network services information at ANX Certification Assessment and periodically during ANX Certification Verification to the ANXO.

2.   The ANXO analyzes the adequacy of the evidence.

3.   The ANXO may periodically or at random intervals audit the ANX CSP during ANX Certification Verification.   ·

2.3 ANX Certification Assessment Requirements

2.3.1 Network Service Categories and Requirements

The components of the four network service categories are part of the network services information to be provided by the ANX CSPs to the ANXO as network services requirements discussed here. These network service components are summarized in Table 2-2 in Section 2.3.1.2 below.

[R2-1.: CertAss]   Basic Services

R   ANX CSPs **shall** provide the following basic network services all of which must be selected by ANX Subscribed TPs.

1.   Connectivity to ANX Subscribed TPs. The ANX CSP **shall** provide Internet Protocol (IP) connectivity to all other ANX Subscribed TPs, whether they are connected to the same ANX CSP or to a different ANX CSP. Connectivity **shall** be provided via dedicated or dialup facilities. See the list of ANX CSP-optional certified services for such facilities.

2.   Help Desk/Customer Care Center

3.   24 x 7 Network Operations Center (NOC)

4.   IP address assignment (for ANX Subscribed TPs who wish to get an IP address block from their ANX CSPs) and registration for ANX Network Service. IP network numbers assigned to ANX Subscribed TPs to be used for ANX Traffic **shall** be globally unique and obtained from an authorized Internet address registry, . ANX CSPs **shall** support routing using such IP addresses to provide reachability to all ANX Subscribed TPs.

5.   ANX Domain Name Service (DNS)

   a)   Domain name assignment and registration, if needed by the ANX Subscribed TP for its company domain name.

b)   Delegation of reverse ("in-addr") DNS service for all ANX address space assigned to the ANX Subscribed TP, to a designated name server.

c)   Secondary Domain Name Service registration and operation for the ANX Subscribed TP company domain name or a subset of zones within the domain, and for in-addr service for zones representing all ANX address space assigned to the ANX Subscribed TP.

d)   Operation of ANX-enabled DNS Server with special configuration for ANX Domain Name Service with "stub" records for ANX Subscribed TP-registered domains found in the stub file made available by the ANXO. See [4], Section 11 (ANX Overseer Services: ANX DNS Service) for a description of the stub records to resolve names for ANX Subscribed TP hosts. Also, see Section 10.4 of this document for ANX CSP requirements regarding retrieval and loading of this file on a daily basis.

6.   For access provided by dedicated connections:

a)   Equipment management. Day-to-day management including configuration and operation of the ANX Subscribed TP premises router and CSU/DSU **shall** be supported and controlled by the ANX CSP, regardless of whether the ANX Subscribed TP owns the equipment, or purchases or leases from the ANX CSP.

b)   Link utilization reports. The ANX CSP **shall** provide monthly reports of individual ANX Subscribed TP access circuit utilization statistics to the ANX Subscribed TP. (Note that the ANX CSP is also required to provide such access circuit utilization statistics to the ANXO for all of its ANX Subscribed TPs. See Access Link Utilization metric in Section 4).

7.   For access provided by dialup connections:

a)   Authenticated PPP access

Measurement Technique:

R   ANX CSP Applicants **shall** submit ANXO a statement of commitment to provide ANX Subscribed TPs all of the ANX CSP Basic Services as described. These services must be selected by the ANX Subscribed TPs. Certification of these services requires determination by the ANXO that the services are offered by the ANX CSP Applicant at ANX Certification Assessment.

[R2-2.: CertAss]   ANX CSP-Required ANX Subscribed TP-Selectable Certified Services

R   ANX CSPs **shall** provide all of the following network service options to ANX Subscribed TPs, to be explicitly selected or explicitly declined by the ANX Subscribed TPs.

1. Primary Domain Name Service

   a) Primary Domain Name Service configuration, update support, and operation for ANX Subscribed TP company domain name and for in-addr service for ANX network numbers assigned to ANX Subscribed TP. Requests for updates to DNS zones **shall** be accepted from TPs via e-mail.

2. Lease or purchase of ANX Subscribed TP premises router for the ANX Subscribed TP

   a) TP premises router hardware and software installation and management, including hardware maintenance and software version updates

   b) Lease, purchase, hardware and software installation, configuration and maintenance of other equipment needed for private line connection, e.g., CSU/DSU, ISDN adapter.

   NOTE: This does not include lease/purchase/installation/management/maintenance of IPSec devices. ANX Subscribed TP may explicitly select or explicitly decline one or more of the above options.

3. Addressing plan including private network routing

   a) The ANX CSP **shall** assist the ANX Subscribed TP to develop a plan for use of IP addressing on the ANX Subscribed TP enterprise network and on the ANX network. The complexity of this plan may range from a very simple plan to install hosts using new public IP addresses assigned by the ANX CSP, to a complex firewall or network address translation system allowing a private IP address-based enterprise network to coexist with the ANX. Note that all ANX traffic uses public IP addressing.

4. Redundant access options to enhance reliability or performance. Note that the ANX CSP-required service offering, where the ANX Subscribed TP does not select the options below, is still subject to all requirements listed in this document. ANX CSPs **shall** offer at least a minimal subset of these redundant access options that are ANX Subscribed TP-selectable in order to meet an ANX Subscribed TP requirement of up to 100% reliability for ANX communication.

   a) Backup connectivity.

      i) Dialup. A dialup capability is offered which will carry traffic in the event of failure of the primary access circuit or related equipment.

      ii) Leased line. A leased line is offered which will carry traffic in the event of failure of the primary access circuit or related equipment.

   b) Last mile diversity/redundancy. When backup connectivity is offered, the Telco access circuit may be ordered such that the backup circuit is installed over a physically diverse path.

    c)   Redundant/alternate site connectivity. Backup connectivity is supplied to a different location on the ANX Subscribed TP network.

Measurement Technique:

R ANX CSP Applicants **shall** commit to offer all of ANX CSP-Required ANX Subscribed TP-Selectable Certified Services as described, to be selected or declined by the ANX Subscribed TPs. Certification of these services requires determination by the ANXO that the services are offered by the ANX CSP Applicant at Certification Assessment.

[R2-3.: CertAss]   ANX CSP-Optional Certified Services

R If an ANX CSP offers all or a subset of these optional network services, the ANX CSP **shall** satisfy all ANX Certification Assessment and ANX Certification Verification requirements listed in this document for these optional services at ANX Certification Assessment.

1.   In addition to the access methods required to be offered by the ANX CSPs, the following access methods may be offered as alternatives or in conjunction with the required access methods listed above. ANX Subscribed TPs may select or decline these optional services if they are offered by the ANX CSP.

    a)   Multihomed access. Support of load sharing or backup across connections to more than one ANX Subscribed TP interface.

    b)   Dialup connections from single PC or LAN via PPP using analog modem or ISDN

    c)   Dedicated connections via private line from 56K to T3

    d)   Fractional T1 private line

    e)   OC3c PPP access via private SONET

    f)   Frame Relay and SMDS (56K - T3)

    g)   ATM (T1 - OC3c)

    h)   xDSL access

    i)   800 number access to certified dialup connections

    j)   Wireless access to certified connections

2.   Home Page or web hosting services with IPSec

3.   EDI profiling, translation, ANX Subscribed TP interworking with IPSec

4.   ANX Application development/pass-through products and services with IPSec

5.   Store and Forward Services with IPSec

6.   CAD file transfer gateways with IPSec

7.   APPN based TCP/IP application priority services with IPSec

8.   All IPSec services **shall** be certified for use on the current ANX Network Release by an independent third party.

Measurement Technique:

R   When offering these optional network services, the ANX CSP Applicant **shall** commit to satisfy all ANX Certification Assessment and ANX Certification Verification requirements listed in this document for these optional services at ANX Certification Assessment. Certification of these services requires determination by the ANXO that the services are compliant with all ANX Certification Assessment and ANX Certification Verification requirements. All IPSec services **shall** be certified for use on the current ANX Network Release by an independent third party, currently International Computer Security Association (ICSA).

2.3.1.1 Other, Value Added, Services

ANX CSPs may make additional features available to ANX Subscribed TPs as long as any resulting network traffic and service processes do not degrade the Service Quality defined by the requirements listed in this document. This is a partial list of example value added services. ANX Subscribed TPs may subscribe to these options if offered by ANX CSPs.

1.   Public Internet access

2.   Customer premises equipment sales (e.g. routers, servers, switches)

3.   Web hosting and configuration

4.   ANX application consulting

5.   Disaster recovery plan for ANX Subscribed TP connectivity

6.   Network or Security Support/Admin/Operations services

7.   Network or Security Audit/Consulting/Design Services

8.   · QOS/data priority services

9.   Bandwidth reservation via ATM SVCs, RSVP, or other methods of providing multiple qualities of service

10.   Support of basic firewalls

11.   Virtual private networks via encrypting firewalls.

12.   IPSec on dial-in port

13.   Trouble Ticket Electronic Access services

This allows the ANX Subscribed TP to obtain the Trouble Ticket status and it allows the ANX CSP to provide the ANX Subscribed TP with e-mail notification on Trouble Ticket opening, closing, and status changes.

2.3.1.2 Components Summary of ANX CSP Network Service Categories

Table 2-2 below summarizes ANX CSP network service components of these service categories.

ANX CSP Network Service Components List	Network Service Categories
1) IP Connectivity to ANX Subscribed TPs	
2) Help Desk/Customer Care Center	
3) 24x7 NOC	
4) IP address assignment and registration for ANX Network Service	
5) ANX Domain Name Service	**ANX CSP Basic Services**
6) For dedicated access: Management of ANX Subscribed TP premises router and DSU; Access Link utilization reports to the ANX Subscribed TP	
7) For dialup access: Authenticated PPP access	
1) Primary Domain Name Service operations, services	
2) Lease or purchase of ANX Subscribed TP premises router for the ANX Subscribed TP	**ANX CSP-Required ANX Subscribed TP-**
3) Addressing plan including private network routing	**Selectable Certified Services**
4) Redundant access options: Backup connectivity, dialup or leased lines; Last mile diversity; Redundant site connectivity	
1) Additional access options: Multihomed access; Dialup connections via PPP over analog/ISDN; Dedicated private line connections; PPP over SONET; FR; SMDS; ATM; xDSL; 800 number access; Wireless access	
2) Home Page or web hosting services with IPSec	**ANX CSP-Optional**
3) EDI profiling, translation, ANX Subscribed TP interworking with IPSec	**Certified Services**
4) ANX application development/pass-through products/services with IPSec	
5) Store and Forward Services with IPSec	
6) CAD file transfer gateways with IPSec	
7) APPN based TCP/IP application priority services with IPSec	
8) IPSec Implementation Certified for use on ANX Release by 3rd Party	
ANX CSP Network Service Components List	**Network Service Categories**
1) Public Internet access	
2) Customer premises equipment sales	
3) Web hosting and configuration	
4) ANX application consulting	
5) Disaster recovery plan for ANX Subscribed TP connectivity	
6) Network or Security Support/Admin/Operations services	**Other Value Added**
7) Network or Security Audit/Consulting/Design Services	**Services**
8) QOS/data priority services	

9) Bandwidth reservation via ATM SVCs, RSVP, or other methods	
10) Support of basic firewalls	
11) Virtual private networks via encrypting firewalls	
12) IPSec on dial-in port	
13) Trouble Ticket Electronic Access services	

Table 2-2: ANX CSP Network Service Components Summary

2.3.2 Other Requirements Regarding Network Services Information

[R2-4.: CertAss] ANX Subscribed TP Customer Premises Equipment Requirements

R ANX CSPs **shall** commit to provide ANXO service description and service features of ANX Subscribed TP Customer Premises Equipment hardware and software, that is managed by the ANX CSP, whenever specifically requested by the ANXO.

Measurement Technique:

R ANX CSP Applicants **shall** provide to the ANXO all information regarding an ANX Subscribed TP's Customer Premises Equipment hardware and software, that is managed by the ANX CSP, whenever specifically requested by the ANXO. This information **shall** include, but is not limited to:

1. Functional configuration diagrams showing all hardware and software required to connect the ANX Subscribed TP to the ANX Network (i.e. types of connections and services provided to each ANX Subscribed TP). This includes Customer Premises Equipment hardware and software, whether it is provided by the ANX CSP or by the ANX Subscribed TP. Vendor model numbers, software versions, and communication interfaces **shall** be included in these descriptions.

2. Verification procedures for ANX CSP managed ANX Subscribed TP Customer Premises Equipment compliance with ANX security requirements described in Section 7 of this document.

[R2-5.: CertAss] Geographic Availability of all Access and Other Certified Services

R ANX CSPs **shall** provide ANXO, geographic availability (or other availability limitations) of all access and other certified services.

Measurement Technique:

R ANX Certification Assessment **shall** be based on submission of this information to ANXO.

[R2-6.: CertAss] Sample Copy of Contract Containing Service-Level Agreements

R ANX CSPs **shall** provide ANXO sample copy of contract containing service-level agreements between ANX CSP and ANX Subscribed TPs.

Measurement Technique:

R Sample copy of contract **shall** include ANX CSP Applicant's standard contractual terms and conditions.

[R2-7.: CertAss]   List of ANX Subscribed TPs and their IP Network Numbers Used for ANX Traffic

R ANX CSPs **shall** provide ANXO list of connected ANX Subscribed TPs and their (globally unique IP) network numbers used for ANX traffic.

Measurement Technique:

R ANX CSP Applicants **shall** commit to provide ANXO the list of connected ANX Subscribed TPs and their (globally unique IP) network numbers used for ANX traffic, and any updates regarding new subscribers and changes in IP network numbers.

2.4 ANX Certification Verification Requirements

2.4.1 Network Service Categories and Requirements

[R2-1.: CertVer]   Basic Services

R ANX CSPs **shall** provide the basic network services listed for ANX Certification Assessment, all of which must be selected by ANX Subscribed TPs.

Measurement Technique:

R ANX CSPs **shall** quarterly submit to ANXO a statement of compliance that they continue to provide ANX Subscribed TPs all of the ANX CSP basic network services as described for ANX Certification Assessment. ANX Subscribed TPs must select all of these ANX CSP services. Certification of these services requires determination by the ANXO that the services are offered, and whether the services continue to be operational.

[R2-2.: CertVer]   ANX CSP-Required ANX Subscribed TP-Selectable Certified Services

R ANX CSPs **shall** provide all of the ANX CSP-required network service options listed for ANX Certification Assessment, to be explicitly selected or explicitly declined by the ANX Subscribed TPs.

Measurement Technique:

R ANX CSPs **shall** confirm in quarterly reports that they continue to provide all the ANX CSP-required network service options to ANX Subscribed TPs. Certification of these services

requires determination by the ANXO that the services are offered, and whether the services continue to be operational.

[R2-3.: CertVer]   ANX CSP-Optional Certified Services

R   If an ANX CSP offers all or a subset of the optional network services listed for ANX Certification Assessment, the ANX CSP **shall** satisfy all ANX Certification Assessment and ANX Certification Verification requirements listed in this document for these optional services .

Measurement Technique:

R   If an ANX CSP offers all or a subset of the optional network services to ANX Subscribed TPs, ANX CSPs **shall** quarterly provide a list of optional services offered and **shall** confirm in reports that they satisfy all ANX Certification Verification requirements listed in this Part 2 document for these optional services. Any new optional services introduced **shall** be clearly marked on the submitted document.   Certification of these services requires determination by the ANXO whether any such services are offered to any ANX Subscribed TPs, and whether these services continue to comply with all ANX Certification Verification requirements listed in this document.

2.4.2 Other Requirements Regarding Network Services Information

[R2-4.: CertVer]   ANX   Subscribed   TP   Customer   Premises   Equipment Requirements

R   ANX CSPs **shall** quarterly reinstate its commitment to provide ANXO service description and new service features of ANX Subscribed TP Customer Premises Equipment hardware and software, that is managed by the ANX CSP, whenever specifically requested by the ANXO.

Measurement Technique:

R   ANX CSPs **shall** provide to the ANXO all information regarding an ANX Subscribed TP's Customer Premises Equipment hardware and software, that is managed by the ANX CSP, whenever specifically requested by the ANXO. This information **shall** include, but is not limited to:

1.   Functional configuration diagrams showing all hardware and software required to connect the ANX Subscribed TP to the ANX network (i.e. types of connections and services provided to each ANX Subscribed TP). This includes Customer Premises Equipment hardware and software, whether it is provided by the ANX CSP or by the ANX Subscribed TP. Vendor model numbers, software versions, and communication interfaces **shall** be included in these descriptions.

2.   Verification procedures for ANX CSP managed ANX Subscribed TP Customer Premises Equipment compliance with ANX security requirements described in Section 7 of this document.

[R2-5.: CertVer]   Geographic Availability of all Access and Other Certified Services

R   ANX CSPs **shall** quarterly provide ANXO any changes in geographic availability (or other availability limitations) of all access and other certified services.

Measurement Technique:

R   ANX Certification Verification **shall** be based on submission of this information to ANXO.

[R2-6.: CertVer]   Sample Copy of Contract Containing Service-Level Agreements

R   ANX CSPs **shall** quarterly provide ANXO a new sample copy of contract containing service-level agreements between ANX CSP and ANX Subscribed TPs, if it has been modified.

Measurement Technique:

R   New sample copy of contract **shall** include ANX CSP standard contractual terms and conditions.

[R2-7.: CertVer]   List of ANX Subscribed TPs and their IP Network Numbers Used for ANX Traffic

R   ANX CSPs **shall** quarterly provide ANXO the list of connected ANX Subscribed TPs and their (globally unique IP) network numbers used for ANX traffic.

Measurement Technique:

R   Each quarterly submission to ANXO **shall** include complete list of connected ANX Subscribed TPs and their (globally unique IP) network numbers used for ANX traffic, clearly marking new subscribers and any updates regarding changes in IP network numbers.

2.5 Summary of Network Service Requirements

Table 2-3 summarizes the network services certification requirements.

ANX Certification Requirements For Network Services								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criteria	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
2-	1	Yes	No	Basic Services	Compliance	Yes	Quarterly	PDF
2-	2	Yes	No	ANX CSP-Required ANX Subscribed TP-Selectable Certified Services	Compliance	Yes	Quarterly	PDF
2-	3	Yes	No	ANX CSP-Optional Certified Services	Compliance	Yes	Quarterly	PDF
2-	4	Yes	No	ANX Subscribed TP Customer Premises Equipment Requirements	Compliance	Yes	Quarterly	PDF
2-	5	Yes	No	Geographic availability (or other availability limitations) of all access and other certified services	Compliance	Yes	Quarterly	PDF
2-	6	Yes	No	Sample copy of ANX CSP-ANX Subscribed TP service-level agreement	Compliance	Yes	Quarterly	PDF
2-	7	Yes	No	List of connected ANX Subscribed TPs with (globally unique IP) network numbers used for ANX Traffic	Compliance	Yes	Quarterly	Excel (using template Q-TPLIST.XLS)

Table 2-3: Network Services Requirements Summary

3. Interoperability Metrics

3.1 Scope

One of the key roles of the ANXO is to establish a process to facilitate interoperability among components and technology that are operated by ANX Participants. Interoperability must be ensured at the point of interconnection between entities and, at a higher level, within the routing policies used to establish reachability and reliability within the ANX. In addition, the ANXO has the specific responsibility to determine and propose technologies and processes for connection to and use of ANX CEPs.

This section covers the interconnection of communicating entities in the ANX, including ANX Subscribed TPs, ANX CSPs, and ANX Certified Exchange Point or ANX Certified Exchange Network Operators (ANX CEPOs or ANX CENOs); and defines metrics, criteria and measurement techniques necessary for certified entities to confirm and maintain compliance with the ANX interoperability and interconnection architecture.

3.1.1 Industry Analysis

Standards in the Internet community apply to protocols, and only rarely do they cover practices by service providers and service descriptions. The protocol standards describe an essentially interoperable architecture, with the Internet Protocol operating at a layer above the data link technology layer. Routers typically support multiple interface types, generally conforming to open interface and link layer standards, but this conformance requirement is limited to those routers that are physically connected to this communication medium. Thus, the IP protocol suite defines a vendor-independent, and therefore interoperable, medium.

Similarly, Internet Service Providers are interconnected using standard communications interfaces and media. Exchange Point Operators (EPOs) offer standard interface configurations on their switches. At a low level, the interconnection of providers provides an interoperable medium.

Beyond the basic communications protocols and interfaces, there is some value in redefining the term "interoperability" to mean the overall quality of service delivered by loosely associated entities. That is, we are concerned with how well, not whether, the ANX Network interoperates as a complete system.

This section of the document attempts to describe a framework for interoperability, in the sense of overall quality of service compliance and verification, and includes specific guidelines for provider cooperation and coordination to benefit the ANX Subscribed TPs.

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3.2 Approach and Methodology

3.2.1 ANX Interconnection Architecture
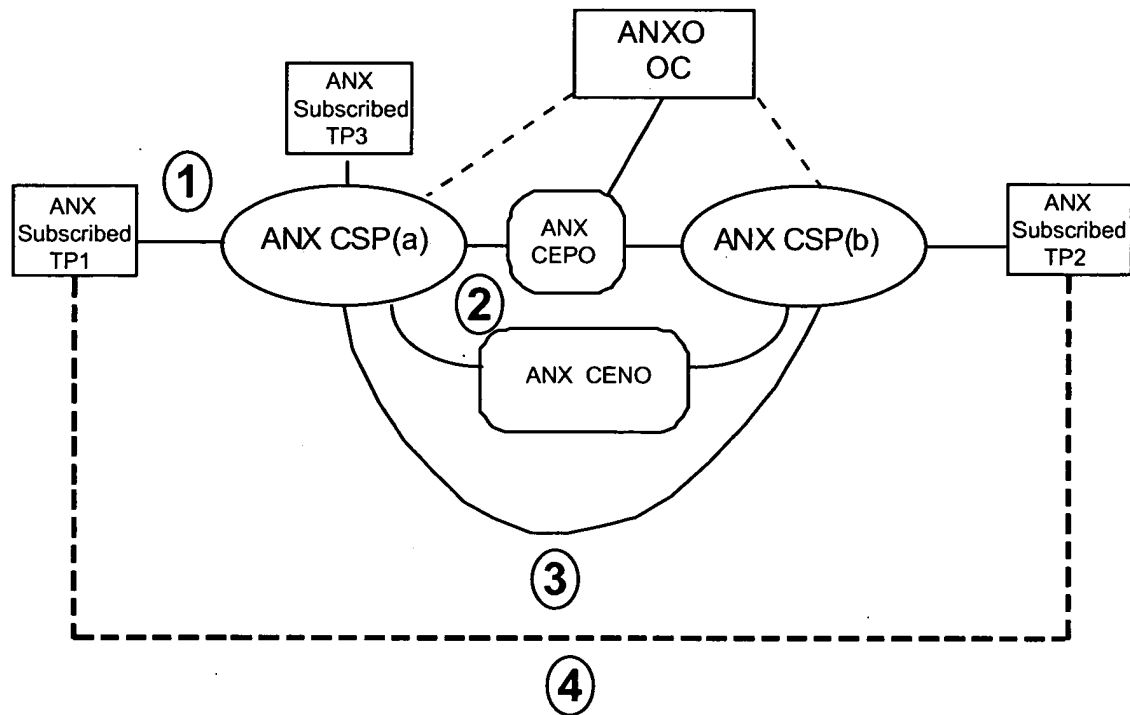
Figure 3-1: ANX Interoperability Architecture Framework

Figure 3-1 shows the possible interconnections between entities ((ANX Subscribed TPs, ANX CSPs, ANX CEPOs, and ANX CENOs). The four numbered reference points serve as reference points for ANX Certification metrics and requirements for ANX CSPs and ANX CEPOs/ANX CENOs as well as to identify the interconnection methods. ANX Certification Assessment and ANX Verification Requirements for Interoperability metrics are provided in Sections 3.3 and 3.4.

3.2.1.1 Reference Point (1): ANX Subscribed TP - ANX CSP

1.   ANX Subscribed TPs obtain service from ANX CSPs. Connectivity is via dedicated or dialup circuit directly to the ANX CSP network, and the service demarc is at the local area network interface of the ANX Subscribed TP-site (or "edge") router. All ANX Access/Connectivity Services - dedicated, dialup, primary, and back up - provided by ANX CSPs to ANX Subscribed TPs, are subject to all ANX Certification Assessment and ANX Certification Verification requirements specified in this document, unless otherwise specified.

2. ANX Subscribed TPs may not be directly connected to ANX CEPO or ANX CENO during ANX Release 1.

3. ANX Subscribed TPs may select full reachability to all Internet destinations, or reachability that is limited to ANX destinations only. Both options may be used, for hosts assigned different sets of address space.

4. Trading Partners may not receive ANX Network Services indirectly, by connecting to an ANX Subscribed TP's network.

3.2.1.2 Reference Point (2): ANX CSP - ANX CEPO/ANX CENO

1. ANX CSPs connect to each other via ANX CEPOs or CENOs (and optionally via private "bi-lateral" connections, see Reference Point (3) below), as illustrated in Figure 3-2. These connections are described as ANX Peering Connections. The ANX CEPOs and ANX CENOs provide an ANX Certified service to the ANX CSPs.

2. ANX Certified Exchange Points (CEPs) and Certified Exchange Networks (CENs) are defined as ATM switches or a network of interconnected ATM switches supporting Permanent Virtual Circuits between ANX CSP routers.

3. The ANX CEPOs and ANX CENOs operate layer 2 services and a limited number of layer 3 services. ANX CSPs, i.e. customers of ANX CEPOs/CENOs, operate their own routers for layer 3 IP communications. Layer 3 interface addresses (IP addresses) for ANX CSP routers for the ANX CEP connection are provided by the ANX CEPO. The layer 3 services offered by ANX CEPOs and ANX CENOs include the operation of ANX Route Servers and Domain Name Service for the layer 3 interface addresses of ANX CSP routers for the ANX CEP connections.

4. The ANX CEPO/ANX CENO takes responsibility for trouble handling of the layer 2 portion of an interconnection between two ANX CSPs, and problems related to the limited layer 3 services operated by the ANX CEPO/ANX CENO. The two ANX CSPs are still jointly responsible for resolving layer 3 problems, and problems regarding any layer 2 circuits, physical lines that they own or lease from other providers, that the ANX CEPO does not have any control over.

5. ANX CSPs may transfer ANX Traffic (ANX Subscribed TP to ANX Subscribed TP, with certain types of Internet traffic allowed—see below and Section 3.3.3.2) across their ANX Peering Connection via the ANX CEPO (via DS3 or OC3c ATM) using only capacity/facilities allocated solely to that function. Capacity/facilities can be physically separate circuits or separate ATM PVCs over the same circuit where the ANX CSP router interfaces support rate shaping and are configured to not exceed the total available bandwidth. Other circuits or PVCs can be used to exchange non-ANX Traffic.

6. ANX CSPs may not use non-certified NAPs or EPs to carry ANX Traffic.

Note: for the rest of this document, ANX CENO and ANX CEPO are both referred to as ANX CEPO, ENO and EPO are both referred to as EPO. Likewise, ANX CEN and ANX CEP are both referred to as ANX CEP, EN and EP are both referred to as EP, and ATM switches and a network of interconnected ATM switches are both referred to as ATM switches.

3.2.1.3 Reference Point (3): ANX CSP - ANX CSP
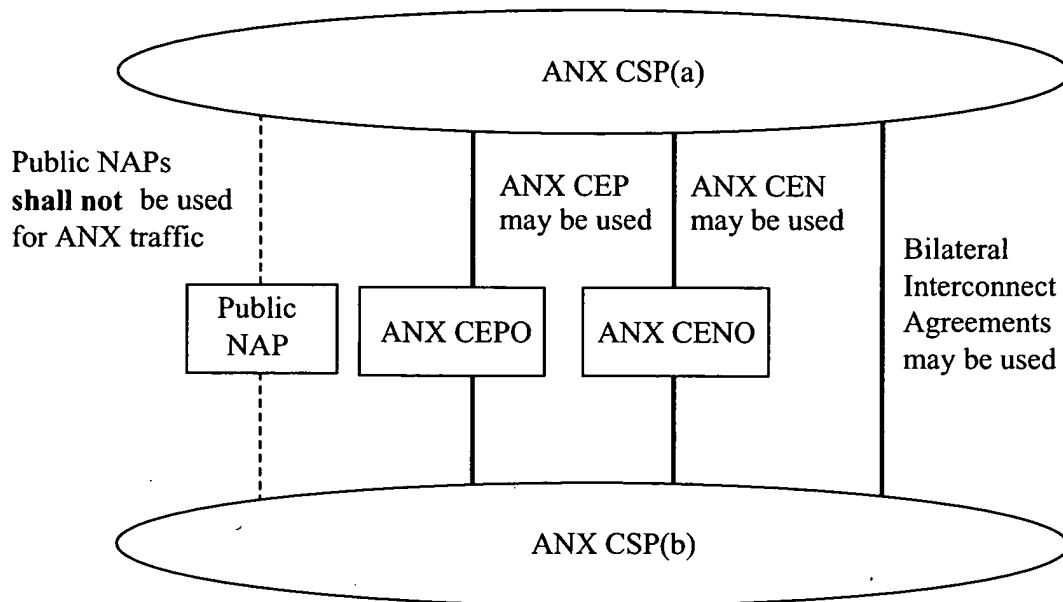
Figure 3-2: ANX CSP-ANX CSP Interconnect Scenarios

1.   ANX CSPs may also connect to each other via "bilateral" or private interconnections (as well as via ANX CEPOs see Reference Point (2) above) using a Layer 2 path, agreed on a bi-lateral basis, as illustrated in Figure 3-2. (examples: bilateral interconnect agreement consisting of physical circuit or ATM PVC).

2.   ANX CSP agreements cover responsibilities for trouble handling on these private interconnections.

3.   ANX CSPs also are responsible for providing suitable redundancy for inter-ANX CSP connections where back-up connections are subject to the same ANX certification requirements as the primary connections.

4.   The maximum number of ANX CSPs in a path between any two ANX Subscribed TPs is two (2) as specified by the full ANX CSP interconnection architecture illustrated in Figure 3-1.

5.   ANX CSPs may not use the capacity/facilities that are allocated to exchange ANX Traffic (ANX Subscribed TP to ANX Subscribed TP), to exchange non-ANX Traffic across their private interconnections, except as provided below, and fully described in Section 3.3.3.2, for a very specific type of Internet traffic which is allowed on ANX capacity/facilities. Capacity/facilities can be physically separate circuits or separate ATM PVCs over the same circuit where both router interfaces support rate shaping and the total available bandwidth is not exceeded.

6.   ANX CSPs choosing to exchange non-ANX Traffic across their private interconnects may allocate separate capacity/facilities to provide such services.

Figure 3-3 illustrates three disallowed interconnection scenarios:

1.   ANX CSPs may not use non-certified ISPs to carry traffic to or from ANX subscribed TPs across ANX CEPOs as illustrated in Figure 3-3 (a). ANX CSPs may exchange traffic with non-certified ISPs for their non-ANX Subscribed TP customers, only over non-ANX capacity/facility circuits.

2.   Non-certified ISPs may not be used as transit between ANX CSPs to carry ANX Traffic as illustrated in Figure 3-3 (b).

3.   ANX CSPs may not use a non-certified ISP to provide layer 3 transport services for an ANX-Subscribed TP as illustrated in Figure 3-3 (c). However, subcontracting layer 2 transport services is allowed for ANX CSPs providing connectivity to ANX-Subscribed TPs.

(a)

(b)

(c)
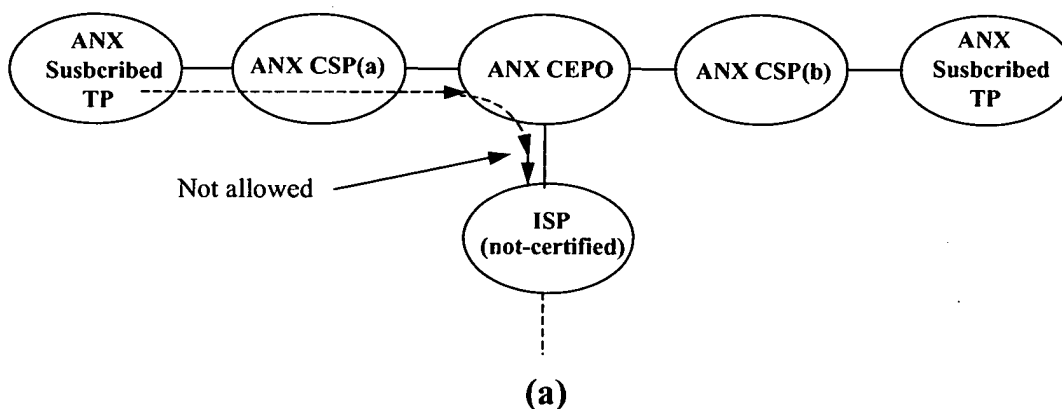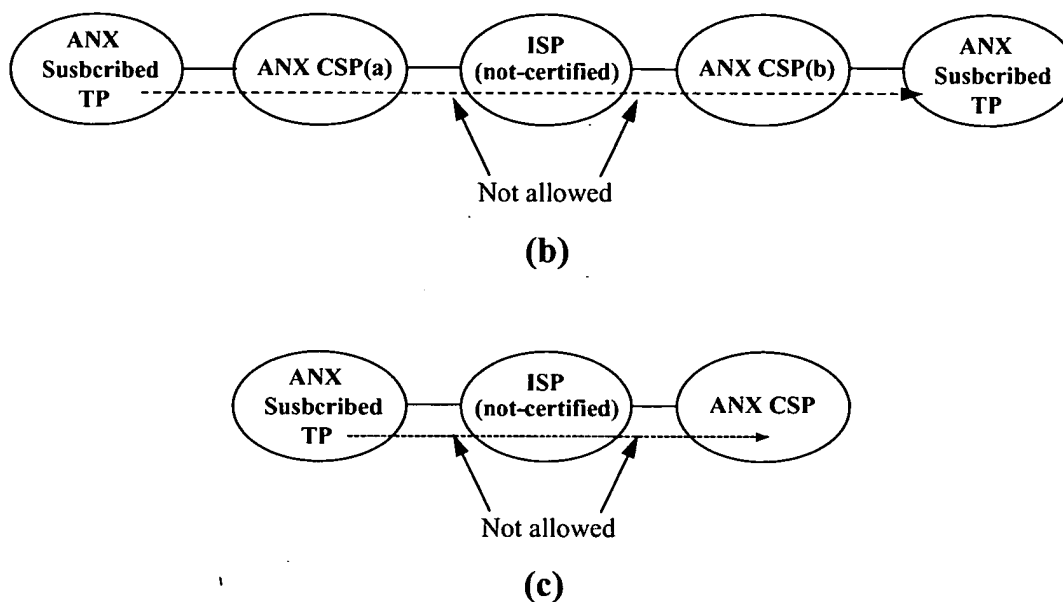
Figure 3-3: Disallowed ANX Subscribed TP Networking Arrangements

1.   All ANX CSPs use the ANX Route Servers (RSs) and the ANX Routing Registry (RR) services (i.e., all ANX CSPs are required to submit their ANX Subscribed TP route information to the ANX Routing Registry and peer with the ANX Route Servers), as shown in Figure 3-6. This enables all ANX CSPs to receive the same ANX reachability information and to provide ANX connectivity to all ANX Subscribed TPs.

2.   ANX CSPs use BGP-4 to peer with the ANX Route Servers (RSs), in order to advertise reachability information of all   ANX Subscribed TPs to whom they provide ANX Network services to all other ANX CSPs. The routing policy of all ANX CSPs supports full reachability among all ANX-Subscribed TPs.   ANX CSPs are required to fully comply with the ANX Peering procedures defined in the ANX Certification Assessment and ANX Certification Verification requirements in this section.

3.   Routing announcements by ANX CSPs support the address assignment choices for ANX-Subscribed TP hosts—ANX-reachability-only ("AO"), dual ANX and Internet reachability (in ANX-assigned address space ["AI"] or in Internet-assigned address space ["IA"]).

4.   ANX Subscribed TPs' address space is announced by ANX CSPs to other ANX CSPs across ANX Certified ANX CSP-ANX CSP interconnect facilities. This causes ANX Traffic (ANX-Subscribed TP to ANX-Subscribed TP) between ANX CSPs to be carried only across ANX Certified ANX CSP-ANX-CSP interconnect facilities. See Figure 3-4

below. However, traffic from non-ANX/Internet customers of a CSP ("IO") may also be transmitted across ANX CSP-ANX CSP interconnect facilities to ANX Subscribed TPs. This type of traffic is permitted, but is not considered ANX Traffic. See Figure 3-5 below. For types of traffic allowed across ANX Certified ANX CSP-ANX CSP interconnects, carried between each pair of host types (AO, AI, IA, IO), see Table 3-1 below.

5.   Address space of Internet customers is never announced by ANX CSPs to other ANX CSPs across ANX Certified ANX CSP-ANX CSP interconnect facilities, therefore traffic in the reverse direction (from an ANX Subscribed TP to an Internet user) shall never be transmitted across ANX Certified ANX CSP-ANX CSP interconnect facilities. Figure 3-5 also illustrates this case.
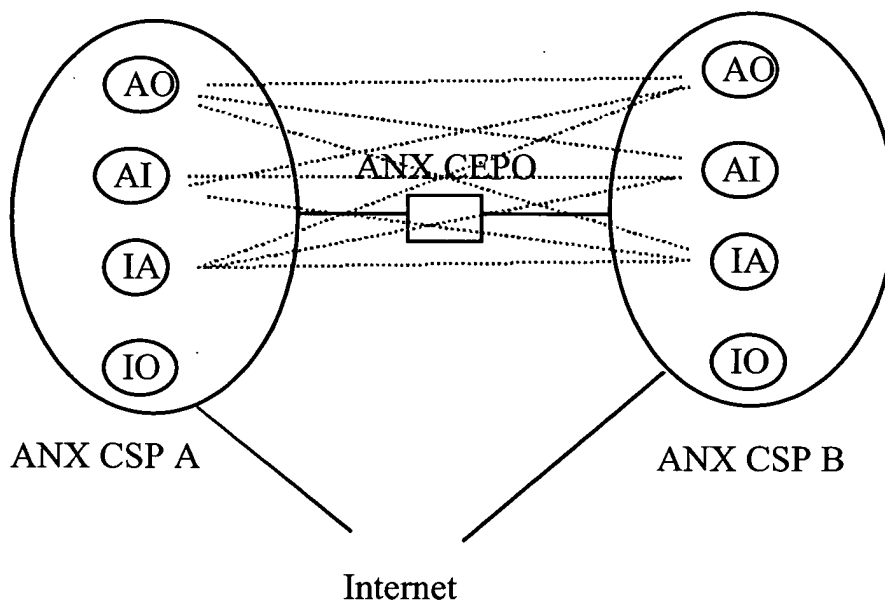
Figure 3-4: ANX Traffic across ANX CEP
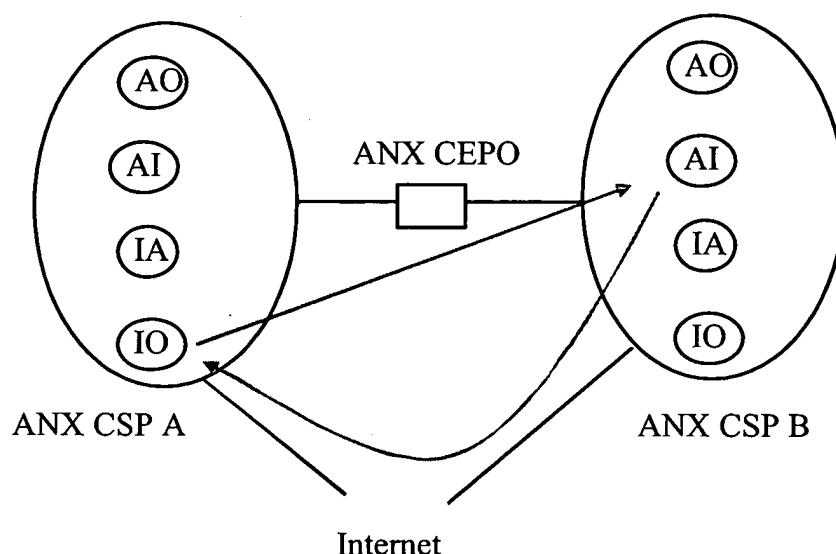
Figure 3-5: ANX Traffic and ANX Subscribed TP Internet Hosts

	TO (→)			
Host Types	**AO**	**AI**	**IA**	**IO**
AO **ANX-only Host**	ALLOWED Uses ANX interconnect facilities	ALLOWED Uses ANX interconnect facilities	ALLOWED Uses ANX interconnect facilities	NOT ALLOWED
AI **ANX-addressed, dual-connectivity host**	ALLOWED Uses ANX interconnect facilities	ALLOWED Uses ANX interconnect facilities	ALLOWED Uses ANX interconnect facilities	NOT ALLOWED
IA **Internet-addressed, dual-connectivity host**	ALLOWED Uses ANX interconnect facilities	ALLOWED Uses ANX interconnect facilities	ALLOWED Uses ANX interconnect facilities	NOT ALLOWED
IO **Internet customer of CSP, including customers of downstream ISPs**	NOT ALLOWED	ALLOWED Uses ANX interconnect facilities	ALLOWED Uses ANX interconnect facilities	NOT ALLOWED

(FROM — row label spanning the four data rows)

Table 3-1: Traffic Across Certified ANX CSP-ANX CSP Interconnect Facilities

Table 3-1 describes the types of traffic allowed to be carried across ANX Certified ANX CSP-ANX CSP interconnect facilities, between each pair of host types (AO, AI, IA, IO).

Figure 3-6 illustrates the mechanisms for maintaining inter-domain routing and reachability information for all ANX Subscribed TPs. ANX CSPs provide routing information to the ANXO for all ANX Subscribed TPs to whom they provide ANX Network Service. The ANXO operates an ANX Routing Registry, an authoritative database containing up-to-date lists of ANX Subscribed TPs, and mapping between ANX CSPs and ANX Subscribed TPs. Each ANX CEPO operates at least two ANX Route Servers which use BGP to advertise ANX Routes to all ANX CSPs. ANX CSPs operate routers which peer with the ANX RSs in order to provide ANX Subscribed TP reachability information to all other ANX CSPs.

Note: Security requirements for confidentiality and privacy of data in the ANXO Routing Registry and Route Server configuration are covered in [4].
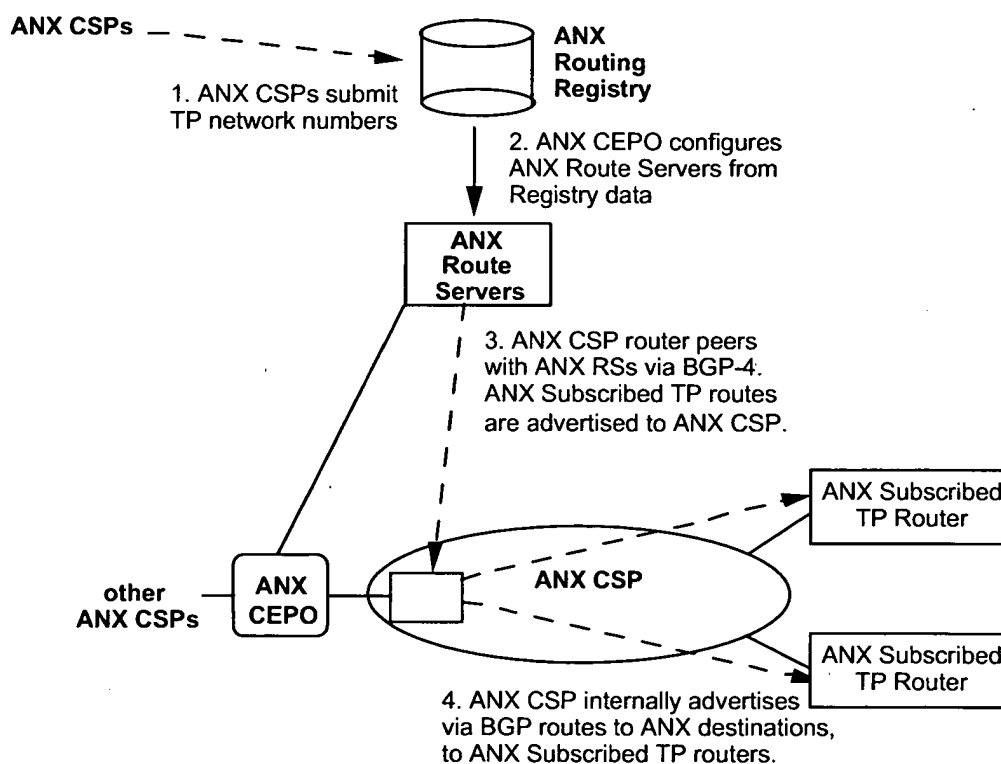
Figure 3-6: ANX Routing Registry

3.2.1.4 ANX Route Server

The ANX Route Server (RS) facilitates routing exchange among the ANX CSPs by gathering routing information from ANX CSP routers, processing the information based on the ANX CSP's routing policy requirements, and passing the processed routing information to each ANX CSP router. The ANX RS re-distributes routing information based on policies explicitly registered in the private ANX RR. The ANX RS uses BGP-4 [Part 6, Ref# 25-26] inter-domain routing protocol to exchange routing information with every other ANX CSP router.

The ANX RS does not forward packets among the ANX CSP routers on the ANX Network. Instead, it uses BGP's third-party routing information capabilities to pass routing information from one ANX CSP to another, with the next hop pointing to the ANX CSP router that advertised the route to the ANX RS. Traffic is therefore exchanged directly among the ANX CSP routers on the ANX network, even though the routing information is provided by the ANX RS.

The ANX RS has the ability to create a Routing Information Base (RIB), known as a "View," for each ANX CSP peer router. The view created for a given ANX CSP maintains routing information which meets the policy requirements of that particular ANX CSP. The view makes it possible for an ANX CSP peering with the ANX RS to obtain the same routing information from the ANX RS that it would if it peered with every other ANX CSP on the ANX Network. That is, if required, the ANX RS could give a different path towards a given destination to different ANX CSPs, if such paths were available and if such a policy was registered in the ANX RR.

Each ANX CEPO operates at least two ANX Route Servers. The ANXO operates the ANX Routing Registry. The ANX CEPO is responsible for producing the configuration file by accessing the ANX RR database for loading in the ANX RS on a regular basis. The ANX CEPO is not responsible for routing problems in the ANX due to incorrect or missing routes in the ANX RR or in BGP sessions. The ANX CEPO is also not responsible for real-time performance of BGP sessions, including delay of routing information due to convergence, routing table loading, or route information transfer except to the extent that the ANX CEPO maintains the ANX RS hardware and performs system administration for the ANX RS software. ANX CSPs are responsible for reliability and performance of BGP sessions with the ANX RS. This includes integrity of routing information transfer within BGP.

3.2.1.5 ANX CSP, ANX CEPO and ANXO Coordination for Routing

The ANX architecture for interconnection of ANX CSPs and for distributing of routing information includes a high level of redundancy for greatest reliability. ANX CSPs, ANX CEPOs and the ANXO each have responsibilities for coordination of their services and for connectivity and configuration in order to make the system work. The following aspects of

service are included for routing coordination, and the configuration is illustrated in Figures 3-7 and 3-8:

1.   Each ANX CEPO operates at least two ANX Route Servers (RSs) with at least one RS at each ANX CEP ATM switch for provision of service to ANX CSPs connected to that ANX CEPO.

2.   One RS is connected to the primary ANX CEPO ATM switch and a second RS is connected to the secondary ATM switch. Additional RSs may be connected to the primary or secondary ATM switch or to a remote location accessible via IP routing over the ANX Network.

3.   ANX CSPs use one or more routers (with redundancy options) for connectivity to the primary and to the backup ANX CEPO switches. (As indicated by the dotted lines in the following figure, separate routers to connect to the primary and backup ANX CEPs are not mandated for ANX Release 1 for cost saving reasons.) Routing policy for ANX CSPs is set to prefer routes accepted from peers via the primary ANX CEP switch. In exchanging ANX Traffic, the secondary ANX CEP switch is used only in the event of a failure of the primary switch or a failure of an ANX CSP's primary circuit. However, routing protocol traffic exchange through the backup ANX CEP switch during normal day-to-day operation is allowed.

4.   BGP sessions with both ANX RSs are established to each ANX CSP router, and are always in production so that the ANX CSP's backup ANX CEP connection will become operational immediately upon failure of the primary ANX CEP connection. See Figure 3-8.

5.   ANX CSPs will schedule tests to simulate failures of the primary ANX CEP circuit in order to ensure that the backup is functional and that ANX Traffic switches over to the backup in a timely fashion, without degrading performance.
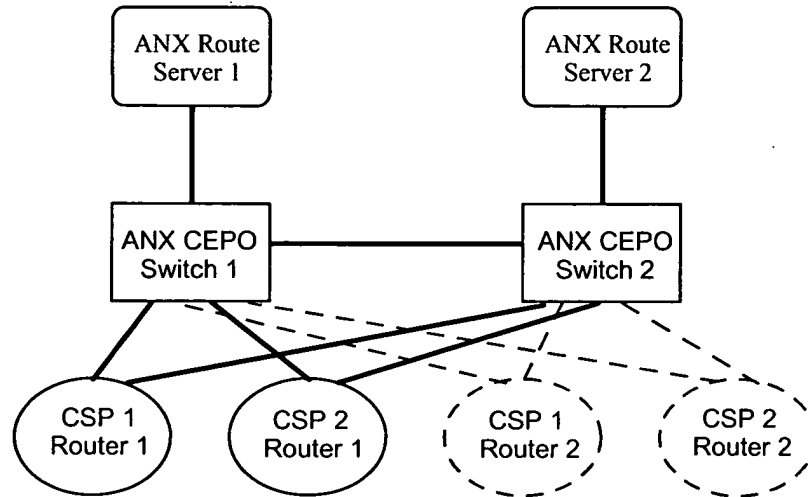
Figure 3-7: Route Server, ANX CSP, ANX CEPO Physical Configuration
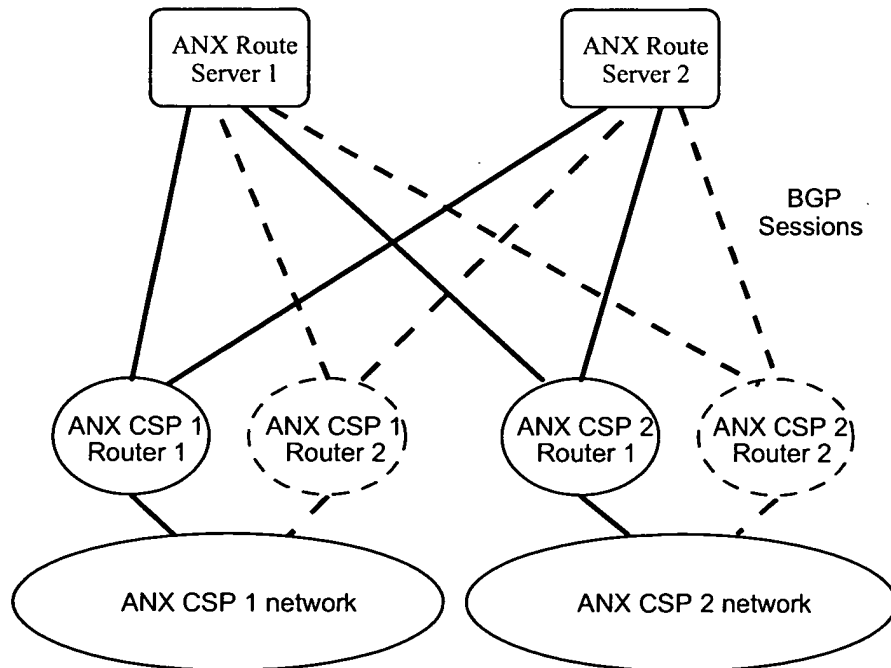
Figure 3-8: Route Server, ANX CSP Logical Peering Configuration

Note that the dotted lines are used in the above figures to indicate that a separate router is not mandated to connect to the backup ANX CEP in ANX Release 1 for cost saving reasons.

3.2.1.6 Reference Point (4): ANX Subscribed TP - ANX Subscribed TP

ANX Subscribed TPs are not certified by the ANXO.

3.2.2 Measurement Architecture

For ANX Certification Assessment and ANX Certification Verification of interconnection architecture and ANX interoperability, no active measurements are used. The ANXO requires reports at assessment time and periodically for verification, which the ANXO will analyze in order to qualify and verify compliance with architectural requirements. The ANXO will periodically audit ANX CSPs and ANX CEPOs.

3.3 ANX Certification Assessment Requirements

3.3.1 TP-ANX CSP Interoperability

Basic service interoperability metrics include data rates, connection technologies, routing protocols and efficient use of IP address space and routing tables. In addition, the ANX Subscribed TP network must be properly configured to utilize ANX CSP services effectively. In addition to the requirements set forth for the network services metrics and criteria, the requirements for ANX Certification Assessment are as follows:

[R3-1.: CertAss]   Multihoming Options

R ANX CSPs **shall** provide multihoming options to ANX Subscribed TPs, compatible with other ANX CSPs. ANX CSPs **shall** allow ANX Subscribed TPs to be multihomed with other ANX CSPs. In this case a dynamic routing protocol, e.g. BGP-4, is allowed at borders with ANX Subscribed TPs; the ANX CSP shall only accept routes agreed upon by the ANX CSP and ANX Subscribed TP.

Measurement Technique:

R ANX CSP Applicant **shall** provide ANXO documentation of options to be offered to ANX Subscribed TPs for multihomed connections. ANX CSP Applicants **shall** agree to provide ANXO the list of their customer ANX Subscribed TPs who are multihomed through them and to identify which other ANX CSPs, if any, are engaged in each multihoming connection of their customers.

3.3.2 ANX CSP-ANX CEPO Interoperability

3.3.2.1 ANX CEPO Requirements for ANX CSP-CEPO Interoperability

[R3-2.: CertAss]   ANX CEP Architecture and Service Set

R   ANX CEPOs **shall** provide ANX Certified EP services to ANX CSPs.

Measurement Technique:

R   ANX CEPO Applicants **shall** document ANX CEP architecture and service set to be used, including options, if any, for private interconnection provided at co-location facilities or via wide area point-to-point connections.

[R3-3.: CertAss]   ANX   CEP   Peering   Establishment,   IP   Address   Assignment Procedures and Domain Name Service

R   ANX CEPOs **shall** provide appropriate configuration of ATM PVCs and ATM parameters to enable peering between ANX CSPs. ANX CEPOs **shall** assign IP addresses which are registered and globally unique to each connected ANX CSP router ATM interface. ANX CEPOs **shall** operate and maintain a Domain Name Service for the IP addresses assigned to each connected ANX CSP router ATM interface.

Measurement Technique:

R   ANX CEPO Applicants **shall** document procedures to enable peering between ANX CSPs including e-mail submission address and any forms or templates necessary to establish PVCs and configure ATM parameters. For each ANX CEP ATM switch, ANX CEPO Applicants **shall** make all IP address assignments and ANX CSP router ATM interface DNS names known to the ANXO and to all connected ANX CSPs.

[R3-4.: CertAss]   ANX CEPO-ANX CSP Connections

R   ANX CEPOs **shall** provide connectivity to all ANX CSPs.

Measurement Technique:

R   ANX CEPO Applicants **shall** issue to the ANXO an initial list of connected ANX CSPs, their connection types and data rates.

[R3-5.: CertAss]   Same Fee Services

R   ANX CEPOs **shall** charge each ANX CSP the same fee for the same service component.

Measurement Technique:

R   ANX CEPO Applicants **shall** provide the ANXO a fee structure on a service components basis for the ANX CEP service they **shall** be offering and a copy of the initial contract for each ANX CSP connected.   ANX CEPO Applicants **shall** indicate to the ANXO the list of service components and the fee charged for each service component.

[R3-6.: CertAss]   Support of ATM PVCs

R   ANX CEPOs **shall** support ATM PVCs.

Measurement Technique:

R   ANX CEPO Applicants **shall** provide ANXO a statement of compliance.

[R3-7.: CertAss]   Support of DS3 and OC3c Connection Rates

R   ANX CEPOs **shall** support DS3 and OC3c connection data rates as basic service options.

Measurement Technique:

R   ANX CEPO Applicants **shall** provide ANXO a statement of compliance.

[R3-8.: CertAss]   Support of at Least DS1 Connection Rates for Back-up ANX CSP Connectivity

R   ANX CEPO **shall** support at least DS1 connection data rates as service options for back-up ANX CSP connectivity.

Measurement Technique:

·R   ANX CEPO Applicants **shall** provide ANXO a statement of compliance.

[R3-9.: CertAss]   Support of Multiple LEC Access, if Available

R   ANX CEPOs **shall** support more than one local carrier if available.

Measurement Technique:

R   ANX CEPO Applicants **shall** provide ANXO a statement of compliance, if multiple LEC access is available.   If multiple LEC access is not available, ANX CEPO Applicants **shall** provide

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ANXO a statement of commitment to comply with this requirement whenever multiple LEC access becomes available.

[R3-10.: CertAss] Adequacy of Co-Location Environmental Metrics

R   ANX CEPOs may offer co-location as an option. If co-location is supported, ANX CEPO **shall** provide adequate environmental features (power, A/C, backup, remote maintenance, etc.).

Measurement Technique:

R   If co-location is supported, ANX CEPO Applicants **shall** provide evidence of adequate environmental features (power, A/C, backup, remote maintenance, etc.) to the ANXO.

[R3-11.: CertAss]   Physically and Geographically Diverse Back-up ANX CEP

R   ANX CEPOs **shall** offer and provide ANXO evidence of connectivity to a back-up ANX CEP switch that is physically and geographically diverse in a metropolitan area from the primary ANX CEP switch. Two switches are considered geographically diverse in a metropolitan area if they are physically separated from each other by a terrestrial distance no smaller than ten (10) miles and are served by physically diverse electric power and access facilities. A back-up ANX CEP switch **shall** comply with all ANX CEPO certification requirements. ANX CEPOs **shall** clearly designate to the ANXO and all ANX CSPs which switch is primary and which is backup.

Measurement Technique:

R   ANX CEPO Applicants **shall** provide ANXO evidence of connectivity to such a physically and geographically diverse back-up ANX CEP switch.

[R3-12.: CertAss]   Adequate Interconnection Facilities Between Primary and Back-up ANX CEP Switches

R   ANX CEPOs **shall** provide adequate interconnection facilities to properly support ANX Traffic between the primary and back-up ANX CEP switches. The capacity for the interconnection of ANX CEP switches **shall** be calculated by the following formula:

Interconnection Capacity $\geq$ 125% * (the highest average load in bits per second among all VCs used to carry traffic between ANX CSPs across the ANX CEP). Average load **shall** be measured during the previous 90 days using periodic SNMP-based sampling at 15 minute time intervals.

Measurement Technique:

R   ANX CEPO Applicants **shall** provide evidence to the ANXO that the primary and back-up ANX CEP switches are interconnected. ANX CEPO Applicants **shall** document the interconnection architecture including the connection type and data rate.

[R3-13.: CertAss]   Operation of ANX Route Servers

R   ANX CEPOs **shall** provide the following for the operation of the ANX Route Servers:

1. Operate at least two machines capable of running Route Server daemon (RSd) with at least one located at the primary ANX CEP and connected to the primary ATM switch and at least one located at the back-up ANX CEP and connected to the back-up ATM switch.

2. Run the latest version of RSd and other software as directed by the ANXO.

3. Allow all ANX CSPs to peer with the ANX Route Servers. This includes the establishment of PVCs from each ANX Route Server to all ANX CSPs.

4. Produce the ANX Route Server configuration file by accessing the ANX Routing Registry every four hours and reload RSd with the new configuration file.

5. Installation of the RSd software and provide regular maintenance.

6. Provide 24x7 monitoring and response to ANX Route Server hardware failures, loss of ATM and IP connectivity, failure of Unix daemons including RSd, and security incidents.

7. Backup and archival storage of logging data.

8. Reliable operation of UNIX system and all applications, e.g. upgrading disk space, memory, swap space, rotating log files, etc.

9. Make any upgrades that may be necessary to improve routing performance as determined by the ANXO. This includes replacement of the system with faster processors, increasing memory based upon the number of routes being advertised, etc.

10. Add and remove ANX Peering sessions with ANX CSPs/ANX CSP Applicants as directed by the ANXO.

11. Operation of specific procedures as requested by ANXO.

Measurement Technique:

R   ANX CEPO Applicants **shall** install the hardware and software at each ANX CEP and provide ANXO with a detailed description of the procedure for compliance to these requirements.

[R3-14.: CertAss]   Adequate Capacity for ANX CEPOs

R   ANX CEPOs **shall** demonstrate adequate capacity within their ANX CEP to properly support traffic between ANX CSPs. ANX CEPOs **shall** be responsible for upgrading the ANX CEP capacity and service quality features and offering ANX CSPs necessary port/trunk connectivity upgrades to support required connection types and data rates, when needed. This will enable ANX CSPs to meet the requirement that average traffic load on the primary ANX CSP-ANX CEPO connection not to exceed 50% of interconnection nominal data rate.

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Measurement Technique:

R ANX CEPO Applicants **shall** commit to upgrade the ANX CEP capacity and service quality features and offering ANX CSPs necessary port/trunk connectivity upgrades to support ANX Traffic, required connection types and data rates, as needed.

[R3-15.: CertAss]   ANX CEPO Back-up Facilities Testing

R ANX CEPO Applicants **shall** perform a back-up facilities test to ensure the following:

1. The back-up switch is functional and traffic switches over to the back-up switch and back-up trunks without degrading performance;

2. The Route Server at the back-up switch is functional and is advertising the correct back-up routes;

3. Restoration of the primary switch results in the peering establishment with the Route Server at the primary switch, advertisement of primary routes and traffic switches back to the primary switch without degrading performance; and

4. The interconnection facility between the primary and back-up EP is functional and is capable of transporting traffic between the switches without degrading performance.

R **Measurement Technique:**
The ANXO **shall** work with the ANX CEPO Applicant to conduct these tests. An ANX CEPO Applicant **shall** successfully complete this test in it's entirety or the ANX CEPO Applicant **shall** re-schedule the test with the ANXO at a later date if any portion of the test fails. These tests require the ANXO and the ANX CEPO Applicant to have connectivity to the primary and back-up EPs. The ANXO and the ANX CEPO Applicant **shall** connect equipment (hereafter referred to as a router) to the ATM switches capable of transporting IP traffic and participating in BGP peering. To confirm all of the points above, the ANXO and the ANX CEPO Applicant **shall** establish connections to the primary and back-up EPs, peer with the two Route Servers, advertise routes to the Route Servers, and pass test traffic, e.g. ping and traceroute. The ANXO **shall** confirm that primary routes are being advertised by the Route Servers and that the test traffic is flowing through the primary circuits and switch. The ANX CEPO Applicant **shall** then disable their primary switch emulating primary EP failure. The ANXO **shall** monitor the test traffic and routes being advertised by the Route Servers. Point 1 succeeds if the test traffic switches over to the back-up switch within 3 minutes. Point 2 succeeds if the ANXO router continues to peer with the Route Server at the back-up EP and, within 3 minutes of disabling the primary switch, the ANXO router contains the back-up routes in its IP routing table. The ANXO **shall** confirm that traffic is flowing through the back-up circuits and switch. The ANX CEPO Applicant **shall** then enable the primary switch emulating the reinstatement of the primary switch. The ANXO **shall** monitor the test traffic, peering, and routes being advertised. Point 3 succeeds if the peering establishment with the Route Server at the primary switch becomes active, the primary

routes are being advertised by the Route Servers, and the test traffic switches back to the primary circuit and primary switch within 3 minutes of enabling the primary switch. The ANXO **shall** confirm that traffic is flowing through the primary circuits and switch. Next, the ANXO **shall** disable their back-up circuit emulating an ANX CSP back-up access link failure and the ANX CEPO Applicant **shall** then disable their primary circuit emulating an ANX CSP primary access link failure. Point 4 succeeds if the test traffic flows through the ANXO's primary link, through the interconnection facility, and out the EPO's back-up link within 3 minutes of the EPO's primary access link failure. Each of these 4 points must be completed successfully, as decided by the ANXO, to pass this metric.

3.3.2.2 ANX CSP Requirements for ANX CSP-CEPO Interoperability

[R3-16.: CertAss] Primary and Backup ANX CEP Connectivity

R ANX CSPs **shall** establish at least two connections to the ANX CEP by contracting with the designated ANX CEPO. One connection to the primary ANX CEP ATM switch **shall** be of DS3 rate or greater, and one connection to the backup ANX CEP ATM switch **shall** be of DS1 rate or greater.

Measurement Technique:

R At the time of initial registration for ANX Certification Assessment, the ANX CSP Applicant **shall** indicate commitment of intent to comply with this requirement. Before ANX Certification Assessment is complete, the ANX CSP Applicant **shall** provide proof of installed, operational and tested connections to the ANX CEP.

[R3-17.: CertAss] ANX CSP-ANX CEPO Border Router Redundancy Requirements

R All routers used by the ANX CSP for ANX CEP connections **shall** have redundant power supplies, hot swap-able interface cards and redundant route switch processors as permitted by the latest router technology, and **shall** be connected to an Uninterruptible Power Supply. ANX CSP **shall** keep on-site spares for all the interface cards of these routers, and **shall** keep copies of the router software image and the configuration file for these routers on a separate computer to allow easy reload if the switch route processor fails and needs to be replaced.

Measurement Technique:

R The ANX CSP Applicant **shall** provide proof of the required router redundancy requirements.

[R3-18.: CertAss]   Adequate Capacity for ANX CSPs

R   ANX CSPs **shall** demonstrate adequate capacity within their backbone and on ANX CSP/ANX CEPO interconnection circuits to properly utilize ANX CEPO for exchange of ANX Traffic between ANX Subscribed TPs. Average expected traffic load on the primary ANX CSP-ANX CEPO connection **shall** not exceed 50% of interconnection bandwidth allocated to ANX Traffic. ANX CSPs **shall** be responsible for upgrading bandwidth and all other service quality aspects of all ANX Connections in order to meet or exceed all ANX Certification requirements.

Measurement Technique:

R   ANX CSP Applicants **shall** commit to upgrade bandwidth and all other service quality features of all ANX Connections to support ANX Traffic, required connection types and data rates, as needed.

[R3-19.: CertAss]   ANX CSP Back-up Access Link Testing

R   ANX CSP Applicants **shall** perform a back-up access link test to ensure the following:

1. The back-up access link is functional and traffic switches over to the back-up ANX CEP switch and back-up trunks without degrading performance; and

2. Restoration of the primary access link results in the peering establishment with the ANX Route Server at the primary ANX CEP switch, advertisement of primary routes and traffic switches back to the primary switch without degrading performance.

Measurement Technique:

R   At the time of initial registration for ANX Certification Assessment, the ANX CSP Applicant **shall** indicate commitment of intent to comply with this requirement. Before ANX Certification Assessment is complete, the ANXO **shall** work with the ANX CSP Applicant to conduct these tests. An ANX CSP Applicant **shall** successfully complete this test in it's entirety or the ANX CSP Applicant **shall** re-schedule the test with the ANXO at a later date if any portion of the test fails. These tests require the ANXO and the ANX CSP Applicant to have connectivity to the primary and back-up ANX CEPs. The ANXO and the ANX CSP Applicant **shall** connect equipment (hereafter referred to as a router) to the ANX CEP ATM switches capable of transporting ANX Traffic and participating in BGP peering. The ANXO and the ANX CSP Applicant **shall** establish connections to the primary and back-up ANX CEPs, peer with the two ANX Route Servers (RSs), advertise routes to the ANX RS, and pass test traffic, e.g. ping and traceroute. The ANXO **shall** confirm that primary routes are being advertised by the ANX RS and that the test traffic is flowing through the primary circuits and switch. The ANX CSP Applicant **shall** then disable their primary access link emulating primary access link failure. The ANXO **shall** monitor the test traffic and routes being advertised by the ANX Route Servers. Point 1 succeeds if, within 3 minutes of the ANX CSP Applicant's primary access link failure, the ANXO router contains the back-up routes in it's IP routing table and the test traffic switches

over to the ANX CSP Applicant's back-up access link. The ANXO **shall** confirm that traffic is flowing through the ANX CSP Applicant's back-up circuit. The ANX CSP Applicant **shall** then enable the primary access link emulating the reinstatement of the primary access link. The ANXO **shall** monitor the test traffic, peering, and routes being advertised. Point 2 succeeds if the ANX CSP Applicant's peering establishment with the ANX Route Server at the primary ANX CEP switch becomes active, the ANX CSP Applicant's primary routes are being advertised by the ANX Route Servers, and the test traffic switches back to the primary circuit within 3 minutes of enabling the ANX CSP Applicant's primary access link. Both of these points must be completed successfully, as decided by the ANXO, to pass this metric.

[R3-20.: CertAss]   Separate Capacity/Facility for ANX and Non-ANX Traffic

R   ANX CSPs **shall** transfer ANX Traffic (ANX Subscribed TP to ANX Subscribed TP) across their ANX CEPO connection using only capacity/facilities specifically allocated to that function. ANX CSPs **shall** use such dedicated capacity/facilities solely to transfer ANX Traffic, except for very specific limited exceptions illustrated in Figure 3.5 and corresponding Table 3.1. Capacity/facilities can be physically separate circuits or separate ATM PVCs over the same circuit where both router interfaces support rate shaping and the total available bandwidth is not exceeded. ANX CSPs choosing to exchange non-ANX Traffic across the same carrier service that operates the ANX CEPO **shall** allocate separate capacity/facilities and bandwidth to provide such services.

Measurement Technique:

R   ANX CSP Applicants **shall** provide ANXO a statement of commitment to comply with this metric at all times.

3.3.3 ANX CSP-ANX CSP Interoperability

[R3-21.: CertAss]   ANX Connectivity to All Other ANX CSPs

R   ANX CSPs **shall** maintain ANX connectivity to all other ANX CSPs.

Measurement Technique:

R   ANX CSP Applicants **shall** document all logical and physical interconnections to other ANX CSPs (through the ANX CEP or bilateral connections).

[R3-22.: CertAss]   Suitable Redundancy for Inter-ANX CSP Connections

R   The ANX CSPs **shall** provide suitable redundancy for inter-ANX CSP connections. Inter-ANX CSP redundancy **shall** be achieved via two or more physically separate and geographically diverse Layer 2 path connections to all other ANX CSPs (examples: connections to multiple geographically diverse ANX CEPOs; connections via multiple bilateral interconnect agreements

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consisting of different physical and geographically diverse circuits; combination of ANX CEPO and bilateral connections). Each redundant ANX CSP-ANX CSP connection, primary and back-up connections alike, **shall** comply with all ANX CSP certification requirements such that the back-up inter-ANX CSP connectivity **shall** enable the ANX CSP to provide ANX Subscribed TPs with ANX Network Service that meets or exceeds all the ANX CSP certification requirements when the primary inter-ANX CSP connection fails. ANX Subscribed TPs **shall** not experience a degradation of ANX Network Service when the primary inter-ANX CSP connection fails. The requirement for minimum data rate for the backup ANX CEPO connection depends on monthly traffic load and is described in Section 3.4.3.

Measurement Technique:

R The ANX CSP Applicants **shall** provide evidence to the ANXO that the ANX CSP Applicant provides suitable redundancy for inter-ANX CSP connections. ANX CSP Applicants **shall** document routing configuration which allows immediate restoration of connectivity over the back-up inter-ANX CSP connection(s) when the primary inter-ANX CSP connectivity fails.

[R3-23.: CertAss]   InterNIC RWHOIS and SWIP Procedures

R ANX CSPs **shall** participate in InterNIC SWIP or RWHOIS procedures for delegation of IP address space to customers.

Measurement Technique:

R ANX CSP Applicants **shall** provide ANXO a statement of compliance, or a statement of commitment to comply with InterNIC SWIP or RWHOIS procedures for delegation of IP address space to customers.

[R3-24.: CertAss]   Exterior Routing Protocol Metric

R ANX CSPs **shall** use BGP version 4 as specified in RFC 1771, for dynamic inter-domain routing at all Exchange Points and Private Interconnects. ANX CSPs **shall** use static routing at borders with ANX Subscribed TPs, including any dialup facilities.

Measurement Technique:

R ANX CSP Applicants **shall** confirm this in a report to the ANXO, including a description of any other routing protocols used in border routers.

[R3-25.: CertAss]   Routing Table Configuration Metric

Router configuration errors, which are more likely to occur with manual route configurations, are known to be a major source of interdomain routing instability and poor network performance. Erroneous route announcements may result in loss of network reachability, blackholing of

legitimate traffic, brownouts or blackouts that may last several hours and may effect reachability and performance network-wide. Configuration tools that automate generation and checking of BGP-4 route configurations (available for various routers) help eliminate this problem.

R ANX CSPs **shall** assure correctness of their routing table configurations, and avoiding erroneous route announcements.

Measurement Technique:

R ANX CSP Applicants **shall** describe to the ANXO the procedures and methodology they use to produce and check its routing tables and advertised routes.

[R3-26.: CertAss]   Routing Stability/Instability Information

R ANX CSPs **shall** periodically report to ANXO routing stability/instability information, containing at least the following:

1.   BGP session uptime

2.   Route flap

Measurement Technique:

R ANX CSP Applicants **shall** commit to provide monthly routing stability/instability reports, including statistics of BGP session uptime and route flap, and to use techniques such as weighted route dampening to limit route flaps.

[R3-27.: CertAss]   Maximum of Two ANX CSPs in a Path between any Two ANX Subscribed TPs

R According to the full ANX CSP interconnection architecture illustrated Figure 3-1, the maximum number of ANX CSPs in a path between any two ANX Subscribed TPs **shall** be two (2).

Measurement Technique:

R ANX CSP Applicants **shall** provide ANXO a statement of commitment to comply with this requirement at all times.

3.3.3.1 Inter-ANX CSP Routing Architecture for ANX and Non-ANX Traffic

ANX Subscribed TPs may each be allocated three separate blocks of address space, to be assigned to:

1.   Hosts which send and receive ANX Traffic only (to and from other ANX Subscribed TPs)

2.   Hosts which may reach Internet and ANX destinations.

3.   Hosts which may reach Internet destinations only.

The following table summarizes the ANX CSP requirements for inter-ANX CSP announcements of address space for ANX and non-ANX Traffic.

Address Type	Announce to other ANX CSPs over ANX-Certified ANX CSP-ANX CSP Facilities	Announce to Internet providers
1. For ANX hosts only	Yes	No
2. For ANX and Internet hosts	Yes	Only if requested by the ANX Subscribed TP
3. For Internet hosts	No	Yes

Table 3-2: ANX CSP-ANX CSP Routing Announcements for ANX and non-ANX Traffic

[R3-28.: CertAss]   Announcement of ANX-Only Addresses

R ANX CSPs **shall** announce all ANX-only addresses to all other ANX CSPs across ANX Certified ANX CSP-ANX CSP interconnect facilities. ANX CSPs may not announce such addresses to non-certified Internet providers.

Measurement Technique:

R ANX CSP Applicants **shall** provide ANXO a statement of commitment to comply with this requirement at all times.

[R3-29.: CertAss]   Announcement of Addresses For Dual (ANX and Internet) Connectivity

R ANX CSPs **shall** announce addresses of hosts requiring dual connectivity to all other ANX CSPs. ANX CSPs **shall** announce such addresses to Internet providers if and only if specifically requested by the ANX Subscribed TP using the address space.

Measurement Technique:

R ANX CSP Applicants **shall** provide ANXO a statement of commitment to comply with this requirement at all times.

[R3-30.: CertAss]   Announcement of Internet Addresses

R ANX CSPs **shall** not announce address space for Internet-only hosts to other ANX CSPs over ANX Certified ANX CSP-ANX CSP facilities.

Measurement Technique:

R ANX CSP Applicants **shall** provide ANXO a statement of commitment to comply with this requirement at all times.

3.3.3.2 ANX Peering Requirements for Route Exchange between all ANX CSPs

Peering for the purposes of this document is defined as the advertising of routes via BGP4 to all ANX CSPs. The peering and transit of non-ANX packets from any ANX CSPs to other ANX CSPs or ISPs is not covered by the ANX Peering requirements, except in the limited case of packets from Internet customers of an ANX CSP ("IO") destined for ANX-Subscribed TPs attached to a different ANX CSP. See Figure 3-5 and corresponding text for an illustration of this case.

[R3-31.: CertAss]   ANX Peering Procedures

R In particular, ANX CSPs **shall** make use of the following procedures for peering of ANX Traffic:

1.   An ANX CSP **shall**:

    a)   explicitly designate all ANX Connections as either primary or back-up connections with respect to announcements of ANX Subscribed TP networks it serves and its policy for exit traffic destined for ANX Subscribed TP networks served by other ANX CSPs;

    b)   specify circuit bandwidth for each ANX Connection;

    c)   peer with the ANX Route Server (RS) and backup RS, using separate routers;

    d)   advertise the routes of all ANX Subscribed TPs to whom it provides ANX Network Services to the ANX RS;

    e)   advertise all routes of ANX Subscribed TPs it serves to the ANX RS in such a way as to enable all the other ANX CSPs to differentiate between primary and secondary ANX Connections (example: via use of the BGP-4 Multi-Exit-Discriminator attribute);

    f)   accept all ANX Routes learned from the ANX RS in ANX CSPs' routers;

    g)   assign the highest preference to ANX Routes learned from the ANX RS than ANX Routes obtained from other peering sessions;

h)   document and report to the ANXO all known instances of non-compliance with these peering procedures by any ANX CSPs participating in ANX Peering;

i)   not provide IP transit for ANX Traffic to other ANX CSPs;

j)   not use default routing for ANX Traffic;

k)   not require other ANX CSPs to enter into peering contract(s) as a requirement for peering ANX Traffic.

An ANX CSP is **NOT required** to:

i)   enter into peering agreement(s) with any ANX CSP in order to peer ANX Traffic;

ii)   announce the routes obtained from non-ANX Network Service providers to the other ANX CSPs.

2.   All ANX CSPs **shall** exchange ANX Routes using BGP4. Routing policy **shall** be specified using RIPE 181.

NOTE: Routes for ANX Subscribed TPs cannot be submitted to the ANX Routing Registry until after Certification. See [Part 6, Ref #1].

Measurement Technique:

R   ANX CSP Applicants **shall** provide ANXO a statement of commitment to comply with all ANX Peering procedures.

[R3-32.: CertAss]   Establishment of Peering for New ANX CSP Applicants

R   ANX CSP Applicants **shall** utilize the following sequential procedures to establish peering as a required set of steps for completing ANX Certification Assessment:

1.   Submit ANX Certification Assessment data for metrics required for ANX Certification Assessment, except the following:

a)   This metric: Establishment of Peering for New ANX CSP Applicants

b)   ANXO Interfacing metrics defined in Section 10 with the exclusion of Section 10.2, Data Collection and Reporting Interface.

2.   Receive approval from ANXO. Approval is granted if the completed Third ANX Certification Assessment Report has been received stating that the ANX CSP Applicant has passed all metrics stated in that report.

3.   Establish a physical connection to the ANX CEP and establish and test an ATM PVC to the ANXO through the ANX CEP.

4.   Establish and test interfaces to the ANXO.

5.   Send contact information (administrative and technical contacts) to the ANXO and the CEPO.

6.   Provide the ANXO with documentation of all physical and logical interconnections to other ANX CSPs.   The description of ANX Connections **shall** include all of the following:

   a)   Layer 2 technology, maximum link speed, and address information;

   b)   Layer 3 address information;

   c)   Mapping of ANX CSP peers to ANX Connections (example: ANX CEP - all ANX CSPs).

7.   Request ANX CEPO to establish an ATM PVC to each ANX CSP. ANX CEPO **shall** inform other ANX CSPs of PVC information. Existing ANX CSPs **shall** accept request for PVC establishment from any new ANX CSP Applicants approved by the ANXO.

8.   Request confirmation from each ANX CSP.

   a)   Upon confirmation, the following actions **shall** be taken:

      i)   ANX CEPO establishes ATM PVC.

      ii)   ANX CEPO informs the ANXO of the new PVC.

      iii)   ANX CEPO updates the published list of virtual circuit assignments.

   b)   If any ANX CSP does not confirm the request to establish an ATM PVC, ANX CEPO escalates to the ANXO.

9.   Submit routing data to ANXO for the ANX Routing Registry. See Section 10.3.5.

10.   Establish BGP session with each ANX Route Server.

11.   Establish optionally BGP session with each ANX CSP. Note that this step can be bypassed. It is an additional option for an ANX CSP to exercise additional peering arrangements with other ANX CSPs, in addition to peering with the ANX RS.

12.   Inform ANXO of completed connectivity.

13.   Perform CEPO testing, including routing on backup circuit.

14.   Report progress and test results to ANXO.

Measurement Technique:

This metric will only be assessed <u>after</u> the completed Third ANX Certification Assessment Report has been received by the ANX CSP Applicant stating that the ANX CSP Applicant has passed all metrics stated in that report.

R   ANX CSP Applicants **shall** execute all of the identified steps including testing, **shall** report progress and test results to ANXO, and **shall** inform ANXO of the completion of connectivity and peering with all the ANX CSPs prior to ANX Certification.

3.3.4 Joint ANX CSP/ANX CEPO Responsibilities

[R3-33.: CertAss] Collaboration with Other ANX Network Service Providers

R   ANX CSPs/ANX CEPOs **shall** collaborate in interconnection arrangements and troubleshooting with other ANX CSPs, ANX CEPOs and ANX CASPs who are ANX Certified to provide ANX Network Service, with the ANXO, and with Applicant ISPs/EPOs as directed by the ANXO.

Measurement Technique:

R   ANX CSPs/ANX CEPO Applicants **shall** commit to cooperate with other ANX CSPs, ANX CEPOs, ANX CASPs, the ANXO and with Applicant ISPs/EPOs as directed by the ANXO.

3.4 ANX Certification Verification Requirements

3.4.1 TP-ANX CSP Interoperability

[R3-1.: CertVer]   Multihoming Options

R   ANX CSPs **shall** provide multihoming options to ANX Subscribed TPs, compatible with other ANX CSPs. ANX CSPs **shall** allow ANX Subscribed TPs to be multihomed with other ANX CSPs. In this case a dynamic routing protocol, e.g. BGP-4, is allowed at borders with ANX Subscribed TPs; the ANX CSP shall only accept routes agreed upon by the ANX CSP and ANX Subscribed TP.

Measurement Technique:

R   ANX CSPs **shall** provide ANXO a documentation of options offered to ANX Subscribed TPs for multihomed connections, quarterly or if any changes occur. Every quarter, ANX CSPs **shall** provide ANXO the list of their customer ANX Subscribed TPs who are multihomed through them and **shall** identify which other ANX CSPs, if any, are engaged in each multihoming connection of their customers.

3.4.2 ANX CSP-ANX CEPO Interoperability

3.4.2.1 ANX CEPO Requirements for ANX CSP-CEPO Interoperability

[R3-2.: CertVer]   ANX CEP Architecture and Service Set

R   ANX CEPOs **shall** provide ANX Certified EP services to ANX CSPs.

Measurement Technique:

R   ANX CEPO **shall** document any additions, deletions or changes to ANX CEP architecture and service set for primary and backup ANX CEPO connections at quarterly intervals.

[R3-3.: CertVer]   ANX CEP Peering Establishment, IP Address Assignment Procedures and Domain Name Service

R   ANX CEPOs **shall** provide appropriate configuration of ATM PVCs and ATM parameters to enable peering between ANX CSPs. ANX CEPOs **shall** assign IP addresses which are registered and globally unique to each connected ANX CSP router ATM interface. ANX CEPOs **shall** operate and maintain a Domain Name Service for the IP addresses assigned to each connected ANX CSP router ATM interface.

Measurement Technique:

R   ANX CEPOs **shall** document any additions, deletions or changes to procedures used to enable peering between ANX CSPs every quarter, or if any changes occur, for future ANXO trouble handling purposes. For each ANX CEP ATM switch, ANX CEPOs **shall** make all IP address assignments and ANX CSP router ATM interface DNS names known to the ANXO and to all connected ANX CSPs.

[R3-4.: CertVer]   ANX CEPO-ANX CSP Connections

R   ANX CEPOs **shall** provide connectivity to all ANX CSPs.

Measurement Technique:

R   ANX CEPOs **shall** quarterly, or upon changes, issue updated reports to the ANXO, listing connected ANX CSPs, their connection types and data rates.

[R3-5.: CertVer]   Same Fee Services

R   ANX CEPOs **shall** charge each ANX CSP the same fee for the same service component.

Measurement Technique:

R   ANX CEPOs **shall** provide the ANXO a copy of the initial contract for each new ANX CSP connected, and any updates to the fee structure and contracts with ANX CSPs, in relation to ANX CEPO charging, on a quarterly basis. ANX CEPOs **shall** indicate to the ANXO any changes, updates, additions, deletions to the list of service components and the fees charged for each service component.

[R3-6.: CertVer]   Support of ATM PVCs

R   ANX CEPOs **shall** support ATM PVCs.

Measurement Technique:

R   ANX CEPOs **shall** provide ANXO a statement of compliance every quarter.

[R3-7.: CertVer]   Support of DS3 and OC3c Connection Rates

R   ANX CEPOs **shall** support DS3 and OC3c connection data rates as basic service options.

Measurement Technique:

R   ANX CEPOs **shall** provide ANXO a statement of compliance every quarter.

[R3-8.: CertVer]   Support of at Least DS1 Connection Rates for Back-up ANX CSP Connectivity

R   ANX CEPOs **shall** support at least DS1 connection data rates as service options for back-up ANX CSP connectivity.

Measurement Technique:

R   ANX CEPOs **shall** provide ANXO a statement of compliance every quarter, or upon changes in connectivity.

[R3-9.: CertVer]   Support of Multiple LEC Access

R   ANX CEPOs **shall** support more than one local carrier if available.

Measurement Technique:

R   ANX CEPOs **shall** provide ANXO a statement of compliance every quarter. ANX CEPOs **shall** inform ANXO of any changes in the number and status of LEC providers.

[R3-10.: CertVer]   Adequacy of Co-Location Environmental Metrics

R   ANX CEPOs may offer co-location as an option. If co-location is supported, ANX CEPO **shall** provide adequate environmental features (power, A/C, backup, remote maintenance, etc.).

Measurement Technique:

R   If co-location is supported, ANX CEPOs **shall** provide evidence of adequate environmental features (power, A/C, backup, remote maintenance, etc.) to the ANXO on a quarterly basis.

[R3-11.: CertVer]   Physically and Geographically Diverse Back-up ANX CEP

R   ANX CEPOs **shall** offer connectivity to a back-up ANX CEP switch that is physically and geographically diverse in a metropolitan area from the primary ANX CEP switch, and compliant with all ANX CEPO certification requirements. ANX CEPOs **shall** clearly designate to all new ANX CSPs which switch is primary and which is backup.

Measurement Technique:

R   ANX CEPOs **shall** provide ANXO evidence of connectivity to such a physically and geographically diverse back-up ANX CEP switch, every quarter or upon any changes in connectivity.

[R3-12.: CertVer]   Adequate Interconnection Facilities Between Primary and Back-up ANX CEP Switches

R   ANX CEPOs **shall** provide adequate interconnection facilities to properly support ANX Traffic between the primary and back-up ANX CEP switches. The capacity for the interconnection of ANX CEP switches **shall** be calculated by the following formula:

Interconnection Capacity $\geq$ 125% * (the highest average load in bits per second among all VCs used to carry traffic between ANX CSPs across the ANX CEP). Average load **shall** be measured during the previous 90 days using periodic SNMP-based sampling at 15 minute time intervals

Measurement Technique:

R   ANX CEPOs **shall** provide evidence to the ANXO that the primary and back-up ANX CEP switches are interconnected on a quarterly basis or upon changes. ANX CEPOs **shall** document the back-up connections of each of the ANX CSPs used to calculate the interconnection capacity. ANX CEPOs **shall** document the interconnection architecture including the connection type and data rate.

[R3-13.: CertVer]   Operation of ANX Route Servers

R   ANX CEPOs **shall** provide the following for the operation of the ANX Route Servers:

1. Operate at least two machines capable of running RSd with at least one located at the primary ANX CEP and connected to the primary ATM switch and at least one located at the back-up ANX CEP and connected to the back-up ATM switch.

2. Run the latest version of RSd and other software as directed by the ANXO.

3. Allow all ANX CSPs to peer with the ANX Route Servers. This includes the establishment of PVCs from each ANX Route Server to all ANX CSPs.

4. Accept the ANX Route Server configuration file from the ANXO at any time in an automated procedure and reload RSd with the new configuration file without making any modifications to the file.

5. Installation of the latest RSd software and provide regular maintenance.

6. Provide 24x7 monitoring and response to ANX Route Server hardware failures, loss of ATM and IP connectivity, failure of unix daemons including RSd, and security incidents.

7. Backup and archival storage of logging data.

8. Reliable operation of UNIX system and all applications, e.g. upgrading disk space, memory, swap space, rotating log files, etc.

9. Make any upgrades that may be necessary to improve routing performance as determined by the ANXO. This includes replacement of the system with faster processors, increasing memory based upon the number of routes being advertised, etc.

10. Add and remove ANX Peering sessions with ANX CSPs/ANX CSP Applicants as directed by the ANXO.

11. Operation of specific procedures as requested by ANXO.

Measurement Technique:

R ANX CEPOs **shall** document to the ANXO, on a quarterly basis or upon changes, the method of compliance for each of the duties described above. Required information includes hardware models, software versions, logical and physical interconnections to ANX CSPs, and methods and procedures used to perform the required functions.

[R3-14.: CertVer] Adequate Capacity for ANX CEPOs

R ANX CEPOs **shall** demonstrate adequate capacity within their ANX CEP to properly support traffic between ANX CSPs. ANX CEPOs **shall** be responsible for upgrading the ANX CEP capacity and service quality features and offering ANX CSPs necessary port/trunk connectivity upgrades to support required connection types and data rates, when needed. ANX CEPOs **shall** notify an ANX CSP if the monthly average traffic load exceeds 50% of interconnection nominal data rate.

Measurement Technique:

R   ANX CEPOs **shall** monthly report average and peak data rates measured over the past month on each access link used for ANX Traffic, and total available and planned interconnection bandwidth. Measurements **shall** be based on SNMP sampling at 15 minute time intervals.

[R3-15.: CertVer]   ANX CEP Back-up Facilities Testing

R   ANX CEPOs **shall** perform an ANX CEP back-up facilities test to ensure the following:

1. The back-up ANX CEP switch is functional and ANX Traffic switches over to the back-up ANX CEP switch and back-up trunks without degrading performance;

2. The ANX Route Server at the back-up ANX CEP switch is functional and is advertising the correct back-up routes;

3. Restoration of the primary ANX CEP switch results in the peering establishment with the ANX Route Server at the primary ANX CEP switch, advertisement of primary routes and ANX Traffic switches back to the primary ANX CEP switch without degrading performance; and

4. The interconnection facility between the primary and back-up ANX CEP is functional and is capable of transporting ANX Traffic between the switches without degrading performance.

Measurement Technique:

R   ANX CEPOs **shall** perform the testing procedure with the ANXO as described for Certification Assessment at the ANXO's discretion. A testing window request **shall** be submitted to the AIAG ITF and upon the AIAG ITF's approval the test **shall** be conducted.

3.4.2.2 ANX CSP Requirements for ANX CSP-CEPO Interoperability

[R3-16.: CertVer]   Primary and Backup ANX CEP Connectivity

R   ANX CSPs **shall** maintain at least two connections to the ANX CEP by contracting with the designated ANX CEPO. One connection to the primary ANX CEP ATM switch **shall** be of DS3 rate or greater, and one connection to the backup ANX CEP ATM switch **shall** be of DS1 rate or greater, and in compliance with the ANX CSP adequate capacity and suitable redundancy requirements.

Measurement Technique:

R   ANX CSPs **shall** quarterly provide proof of operational connections to the ANX CEP.

[R3-17.: CertVer]   ANX CSP-ANX CEPO Border Router Redundancy Requirements

R   All routers used by the ANX CSP for ANX CEP connections **shall** have redundant power supplies, hot swap-able interface cards and redundant route switch processors as permitted by the latest router technology, and **shall** be connected to an Uninterruptible Power Supply. ANX CSP **shall** keep on-site spares for all the interface cards of these routers, and **shall** keep copies of the router software image and the configuration file for these routers on a separate computer to allow easy reload if the switch route processor fails and needs to be replaced.

Measurement Technique:

R   The ANX CSP **shall** quarterly provide proof of the required router redundancy requirements.

[R3-18.: CertVer]   Adequate Capacity for ANX CSPs

R   ANX CSPs **shall** demonstrate adequate capacity within their backbone and on ANX CSP/ANX CEPO interconnection circuits to properly utilize ANX CEPO for traffic between ANX Subscribed TPs. Monthly average traffic load on the primary ANX CSP-ANX CEPO connection **shall** not exceed 50% of interconnection bandwidth allocated to ANX Traffic. ANX CSPs **shall** be responsible for upgrading bandwidth and all other service quality aspects of all ANX Connections in order to meet or exceed all ANX Certification requirements.

Measurement Technique:

R ANX CSPs **shall** monthly report average and peak data rates measured over the past month on each ANX CSP/ANX CEPO interconnection circuit used for ANX Traffic, and total available and planned interconnection bandwidth. Measurements **shall** be based on SNMP sampling at 15 minute time intervals.

[R3-19.: CertVer]   ANX CSP Back-up Access Link Testing

R ANX CSPs **shall** perform a back-up access link test to ensure the following:

1. The back-up access link is functional and ANX Traffic switches over to the back-up ANX CEP switch and back-up trunks without degrading performance; and

2. Restoration of the primary access link results in the peering establishment with the ANX Route Server at the primary ANX CEP switch, advertisement of primary routes and ANX Traffic switches back to the primary ANX CEP switch without degrading performance.

Measurement Technique:

R ANX CSPs **shall** perform the testing procedure with the ANXO as described for Certification Assessment at the ANXO's discretion. A testing window request **shall** be submitted to the AIAG ITF and upon the AIAG ITF's approval the test **shall** be conducted.

[R3-20.: CertVer]   Separate Capacity/Facility for ANX and Non-ANX Traffic

R ANX CSPs **shall** transfer ANX Traffic (ANX Subscribed TP to ANX Subscribed TP) across their ANX CEPO connection using only capacity/facilities specifically allocated to that function. ANX CSPs **shall** use such dedicated capacity/facilities solely to transfer ANX Traffic, except for very specific limited exceptions illustrated in Figure 3.5 and corresponding Table 3.1. Capacity/facilities can be physically separate circuits or separate ATM PVCs over the same circuit where both router interfaces support rate shaping and the total available bandwidth is not exceeded. ANX CSPs choosing to exchange non-ANX Traffic across the same carrier service that operates the ANX CEPO **shall** allocate separate capacity/facilities and bandwidth to provide such services.

Measurement Technique:

R ANX CSPs **shall** provide ANXO a statement of compliance on a quarterly basis.

3.4.3 ANX CSP-ANX CSP Interoperability

[R3-21.: CertVer]   ANX Connectivity to All Other ANX CSPs

R ANX CSPs **shall** maintain ANX connectivity to all other ANX CSPs.

Measurement Technique:

R   ANX CSPs **shall** document all logical and physical interconnections to other ANX CSPs , every quarter, or upon changes. ANX CSPs **shall** inform the ANXO of any additions or deletions of ANX CSP connections and peer sessions, and changes to primary or secondary status for any ANX Connections or peer sessions.

[R3-22.: CertVer]   Suitable Redundancy for Inter-ANX CSP Connections

R   The ANX CSPs **shall** provide suitable redundancy for inter-ANX CSP connections. Inter-ANX CSP redundancy **shall** be achieved via two or more physically separate and geographically diverse Layer 2 path connections to all other ANX CSPs (examples: connections to multiple geographically diverse ANX CEPOs; connections via multiple bilateral interconnect agreements consisting of different physical and geographically diverse circuits; combination of ANX CEPO and bilateral connections). Each redundant ANX CSP-ANX CSP connection, primary and back-up connections alike, **shall** comply with all ANX CSP certification requirements such that the back-up inter-ANX CSP connectivity **shall** enable the ANX CSP to provide ANX Subscribed TPs with ANX Network Service that meets or exceeds all the ANX CSP certification requirements when the primary inter-ANX CSP connection fails. ANX Subscribed TPs **shall** not experience a degradation of ANX Network Service when the primary inter-ANX CSP connection fails. ANX CSP **shall** document that it continues to maintain the ability to immediately restore connectivity over the back-up inter-ANX CSP connection(s) when the primary inter-ANX CSP connectivity fails.

- ANX CSPs **shall** obtain back-up connectivity via an ATM PVC to an ANX CEP. For this backup connection, the bandwidth provided to each VC **shall** be of adequate capacity to carry 125% of the average load (measured during the previous 90 days) on the equivalent VC on the primary ATM circuit. The ANX CSP **shall** meet or exceed all the performance, reliability, security, business continuity and disaster recovery, and interoperability certification requirements when the primary inter-ANX CSP connectivity fails.

Measurement Technique:

R   The ANX CSPs **shall** provide evidence to the ANXO every quarter that the ANX CSP provides suitable redundancy for inter-ANX CSP connections, with bandwidth allocated to carry 125% of the average load on the equivalent VC on the primary ATM circuit. The average load on the primary ATM circuit **shall** be measured during the previous 90 days, using periodic SNMP-based sampling at 15 minute time intervals. ANX CSPs **shall** also document any additions, deletions or changes in routing configuration and procedures, if any, to be followed to immediately restore connectivity over the back-up inter-ANX CSP connection(s) when the primary inter-ANX CSP connectivity fails.

[R3-23.: CertVer] InterNIC RWHOIS and SWIP Procedures

R   ANX CSPs **shall** participate in InterNIC SWIP or RWHOIS procedures for delegation of IP address space to customers.

Measurement Technique:

R   ANX CSPs **shall** document every quarter, or upon additions, deletions or changes, their participation in InterNIC SWIP or RWHOIS procedures for delegation of IP address space to customers.

[R3-24.: CertVer] Exterior Routing Protocol Metric

R   The ANX CSP **shall** use BGP version 4 as specified in RFC 1771, for dynamic inter-domain routing at all Exchange Points and Private Interconnects. The ANX CSP **shall** use static routing at borders with ANX Subscribed TPs, including any dialup facilities.

Measurement Technique:

R Every quarter, the ANX CSP **shall** state compliance to this metric in a report to the ANXO, including a description of any changes in other routing protocols used in border routers.

[R3-25.: CertVer]   Routing Table Configuration Metric

R The ANX CSP **shall** assure correctness of their routing table configurations, and avoiding erroneous route announcements..

Measurement Technique:

R Every quarter, the ANX CSP **shall** describe to the ANXO the procedures and methodology it uses to produce and check its routing tables and advertised routes.

[R3-26.: CertVer]   Route Stability/Instability Information

R ANX CSPs **shall** periodically report to ANXO routing stability/instability information, containing at least the following:

1. BGP session uptime, as measured by collection of information from inter-ANX CSP border routers; and

2. Route flap, also as measured by statistics collection from inter-ANX CSP border routers.

Measurement Technique:

R ANX CSPs **shall** provide monthly routing stability/instability reports, including statistics of BGP session uptime and route flap. Statement of compliance with use of weighted route dampening to limit route flaps, **shall** be included in these reports.

[R3-27.: CertVer]   Maximum of Two ANX CSPs in a Path between any Two ANX Subscribed TPs

R According to the full ANX CSP interconnection architecture illustrated in Figure 3-1, the maximum number of ANX CSPs in a path between any two ANX Subscribed TPs **shall** be two (2).

Measurement Technique:

R ANX CSPs **shall** provide ANXO a statement of compliance every quarter.

3.4.3.1 Inter-ANX CSP Routing Architecture for ANX and Non-ANX Traffic

The ANX verification requirements for inter-ANX CSP announcement of address space for ANX and non-ANX Traffic are the same as summarized for ANX Certification Assessment in Table 3-3.

[R3-28.: CertVer]   Announcement of ANX-Only Addresses

R   ANX CSPs **shall** announce all ANX-only addresses to all other ANX CSPs across ANX Certified ANX CSP-ANX CSP interconnect facilities.   ANX CSPs may not announce such addresses to non-certified Internet providers.

Measurement Technique:

R   ANX CSPs **shall** provide ANXO a statement of compliance every quarter.

[R3-29.: CertVer]   Announcement of Addresses for Dual (ANX and Internet) Connectivity

R   ANX CSPs **shall** announce addresses of hosts requiring dual connectivity to all other ANX CSPs. ANX CSPs **shall** announce such addresses to Internet providers if and only if specifically requested by the ANX Subscribed TP using the address space.

Measurement Technique:

R   ANX CSPs **shall** provide ANXO a statement of compliance every quarter.

[R3-30.: CertVer]   Announcement of Internet Addresses

R   ANX CSPs **shall** not announce address space for Internet-only hosts to other ANX CSPs over ANX-certified ANX CSP-ANX CSP facilities.

Measurement Technique:

R   ANX CSPs **shall** provide ANXO a statement of compliance every quarter.

3.4.3.2 ANX Peering Requirements for Route Exchange between all ANX CSPs

[R3-31.: CertVer]   ANX Peering Procedures

R   All ANX CSPs **shall** fully comply, on a day-to-day basis, with the ANX Peering procedures described in Section 3.3.3.2.

Measurement Technique:

R ANX CSPs **shall** provide ANXO a statement of compliance and verify full compliance with ANX Peering procedures every quarter.

[R3-32.: CertVer] Establishment of Peering for New ANX CSP Applicants

R ANX CEPOs **shall** provide connectivity and set up PVCs to each ANX CSP for new ANX CSP Applicants approved by the ANXO, and ANX CSPs **shall** exchange routing information via the ANX Route Servers regarding new ANX CSP Applicants upon being connected to the ANX CEPO switch.

Measurement Technique:

R ANX CEPOs and ANX CSPs **shall** provide ANXO a statement of compliance with the procedures for connectivity and establishment of peering for new ANX CSP Applicants every quarter.

3.4.4 Joint ANX CSP/ANX CEPO Responsibilities

[R3-33.: CertVer] Collaboration with Other ANX Network Service Providers

R ANX CSPs/ANX CEPOs **shall** collaborate in interconnection arrangements and troubleshooting with other ANX CSPs, ANX CEPOs and ANX CASPs who are ANX Certified to provide ANX Network Service, with the ANXO, and with Applicant ISPs/EPOs as directed by the ANXO.

Measurement Technique:

R ANX CSPs/ANX CEPOs **shall** provide ANXO a statement of compliance every quarter.

3.5 Summary of Interoperability Requirements
Table 3-3 summarizes Interoperability requirements.

ANX Certification Requirements For Interoperability

Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
3-	1	Yes	No	Multihoming options (compatible with other ANX CSPs)	Compliance	Yes	Quarterly, or if changes	PDF
3-	2	No	Yes	ANX CEP architecture and service set	Compliance	Yes	Quarterly	PDF
3-	3	No	Yes	ANX CEP peering establishment, IP Address Assignment procedures and Domain Name Service	Compliance	Yes	Quarterly, or if changes	PDF
3-	4	No	Yes	ANX CEPO-ANX CSP connections	Compliance	Yes	Quarterly, or if changes	PDF
3-	5	No	Yes	Same fee services	Compliance	Yes	Quarterly, or if changes	PDF, or hardcopy
3-	6	No	Yes	Support of ATM PVCs	Compliance	Yes	Quarterly, or if changes	PDF
3-	7	No	Yes	Support of DS3 and OC3c connection rates	Compliance	Yes	Quarterly, or if changes	PDF
3-	8	No	Yes	Support of at least DS1 connection rates for back-up ANX CSP connectivity	Compliance	Yes	Quarterly, or if changes	PDF
3-	9	No	Yes	Support of multiple LEC access, if available	Compliance	Yes	Quarterly, or if changes	PDF
3-	10	No	Yes	Adequate co-location environmental metrics	Compliance	Yes	Quarterly	PDF
3-	11	No	Yes	Back-up ANX CEP facility at a geographically diverse location from the primary ANX CEP facility	Compliance	Yes	Quarterly, or if changes	PDF
3-	12	No	Yes	Adequate Interconnection Facilities Between Primary and Back-up ANX CEP Switches	Compliance	Yes	Quarterly, or if changes	PDF

3-	13	No	Yes	Operation of ANX Route Servers	Compliance	Yes	Quarterly, or if changes	PDF
3-	14	No	Yes	Adequate capacity for ANX CEPOs	Utilization measurement and switch capacity	Yes	Monthly	PDF
3-	15	No	Yes	ANX CEPO Back-up Facilities Testing	Testing Completion	Yes	AIAG ITF approval	PDF
3-	16	Yes	No	Primary and Backup ANX CEP Connectivity	primary ≥ DS3, backup ≥ DS1	Yes	Quarterly	PDF
3-	17	Yes	No	ANX CSP-ANX CEPO Border Router Redundancy Requirements	Compliance	Yes	Quarterly	PDF
3-	18	Yes	No	Adequate capacity for ANX CSPs	average traffic load on primary ANX CSP-ANX CEPO connection ≤ 50% of nominal interconnection data rate	Yes	Monthly	PDF
3-	19	Yes	No	ANX CSP Back-up Access Link Testing	Testing Completion	Yes	AIAG ITF approval	PDF
3-	20	Yes	No	Separate capacity/facility for ANX and non-ANX Traffic through CEPO interconnections	Compliance	Yes	Quarterly	PDF
3-	21	Yes	No	ANX connectivity to all other ANX CSPs	Compliance	No	Quarterly	PDF
3-	22	Yes	No	Suitable redundancy for inter-ANX CSP connections	Compliance	Yes	Quarterly, or if changes	PDF
3-	23	Yes	No	InterNIC RWHOIS and SWIP procedures	Compliance	Yes	Quarterly, or if changes	PDF
3-	24	Yes	No	Exterior Routing Protocol Metric	Compliance	Yes	Quarterly	PDF
3-	25	Yes	No	Routing Table Configuration Metric	Compliance	Yes	Quarterly	PDF
3-	26	Yes	No	Routing Stability/Instability Information (BGP session uptime and route flap)	Compliance	Yes	Monthly	PDF
3-	27	Yes	No	Maximum of 2 ANX CSPs in a Path between any 2 ANX Subscribed TPs	Compliance	Yes	Quarterly	PDF
3-	28	Yes	No	Announcement of ANX-only addresses	Compliance	Yes	Quarterly	PDF

3-	29	Yes	No	Announcement of addresses for dual (ANX and Internet) connectivity	Compliance	Yes	Quarterly	PDF
3-	30	Yes	No	Announcement of Internet addresses	Compliance	Yes	Quarterly	PDF
3-	31	Yes	No	ANX Peering Procedures	Compliance	Yes	Quarterly	PDF
3-	32	Yes	Yes	Establishment of Peering for New ANX CSP Applicants	Compliance and Testing Completion	Yes	Quarterly	PDF
3-	33	Yes	Yes	Collaboration with Other ANX Network Service Providers	Compliance	Yes	Quarterly, or if changes	PDF

Table 3-3: Interoperability Requirements Summary

4. Performance Metrics

4.1 Scope

Performance metrics are those that quantify or describe a property of the packet transport which directly or indirectly affects the Quality of Service experienced by the application. The fundamental performance metrics are packet loss, delay and throughput. These are directly observable by the application. The network properties that most significantly influence loss, delay and throughput are the relative offered load on links and router processors. As for all queuing systems, the degradation in performance rises asymptotically as the load on a link or processor approaches its finite capacity. Because of this inherent instability in any critically loaded system, the loads on links and processors must be kept below the "knee of the curve". In a complex network, the problem of finding this safe operating region is compounded by both the interactions among different network elements and the natural burstiness of network traffic. Internet traffic is extremely bursty, exhibits high long-range dependence, and as a result, the safe link and processor utilization limits can sometimes be counter-intuitively low.

The fact that Internet routers are typically designed with a central processor that handles routing information and forwarding of exceptional packets implies that an overloaded link can result in an overloaded processor. Conversely, if a router fails to send routing updates to its neighbors, they may assume it is down and then re-route large amounts of traffic. This effect couples link overload to processor overload. Therefore, the only way to ensure high user-perceived performance is to avoid the internal network overloads which are so widespread in today's Internet and contribute to its poor performance.

4.1.1 Industry Analysis

Packet Loss can be caused by congestion (buffer overflow), misrouting, or dropping by the transport layer upon checksum failure. In the case of the latter two loss mechanisms, the excessive packet loss may serve as an early indication of some systematic problem. A high bit error rate would indicate a noisy physical network link, and loss due to erroneous routing might indicate a misconfigured routing table. The more common cause of high packet loss is network overload and congestion which is caused by insufficient network capacity, given the load.

The simple network utility, **ping,** which is used to estimate average round trip delay (RTD) may also be used to measure end-to-end packet loss rates. A tool called **Scion** has been developed by Merit Networks. This can estimate the packet loss rate by analyzing the packets in and packets out data collected from two SNMP-capable network elements located at each end of a link. (Note, most of the Merit tools mentioned here were developed with U.S. government funding, and are freely available.)

Packet Delay: Measuring the packet delay and keeping it within certain bounds is important in the Internet, even for non-real-time applications such as file transfers. The Round Trip Delay (RTD) is the time elapsed for a packet to travel from a source host to a destination host and for its corresponding response to return. The TCP protocol dynamically measures the round trip delays for its packets and adjusts its time-out value based on a weighted average of these measurements. RTD is also measured by the Internet Control Message Protocol (ICMP) in echo request and reply messages. The well-known Unix utilities, **ping** and **traceroute,** use ICMP messages to measure average RTD values.

One-Way Delay is the time elapsed for a packet to travel from a source host to a destination host and is more difficult to measure than RTT. Measuring the one-way delay requires cooperation between the source host and the destination host, such as the source host time-stamping the packet delivered and the destination host recording the time it received the packet. In order for it to be a credible measurement, the sender and receiver must have synchronized clocks.

Jitter is a measure of delay variation, expressed the maximum delay minus the minimum delay.

Minimum Delay is the combined propagation and processing delays any packet would experience over the connection, i.e. the least delay that would be observed without any cross-traffic.

Maximum Delay is the maximum delay a packet could have while still being useful or acceptable. For example, for TCP connections, the maximum RTD would be bounded by the TCP time-out which is dynamically adjusted to a weighted average of the RTDs continuously measured for each packet transmitted and acknowledged.

Throughput or Capacity metrics are those that relate to the average amount of application data transferred in a unit of time.

Bulk Flow Capacity is the maximum rate at which data can be transferred over a transmission path from a source host to a destination host. When the transmission path encompasses multiple nodes and physical links, the bulk flow capacity may be limited by the bandwidth of the slowest link on the transmission path, which is called the bottleneck link.

Possible tools to measure bulk flow capacity are a new IP performance tool called **treno** and a widely used TCP/UDP performance measurement tool called **ttcp.** However, to correctly measure the actual bulk capacity, ttcp requires that no cross-traffic exists at the time of the measurement, and that the TCP applications at the source and destination are tuned to take advantage of the full link capacity (e.g., use of MTU discovery, large TCP windows in large bandwidth-delay product networks, etc.).

Throughput is the average data transmission rate that an application experiences over a transmission path. However, it is different from the bulk flow capacity metric since there could possibly be cross traffic competing for the same network resources during the data transmission.

ttcp is a tool to measure end-to-end TCP or UDP level application throughput in a given network configuration. However, it does so by transmitting its own user-level data and it can potentially contribute to congestion in the network. Accurate ttcp measurements often require no cross-traffic, or known, controlled levels of cross-traffic.

Link Utilization is the ratio of total aggregate traffic carried over a link to the bandwidth of the link. Link utilization can be measured using specialized equipment designed to capture and record traffic as it passes through. **OC3Mon** is a tool developed by NLANR and MCI, which can record every byte of a stream of ATM cells flowing on an OC3 (155 Mb/s) link. (OC3Mon was also government funded, and is freely available.) Bellcore has similar tools for recording full streams of traffic on frame relay, ATM and IP over T1 links.

Routing Metrics are those metrics that are relevant to the interdomain routing information, procedures and policies. These quantities are mainly applicable within an ISP's network, and would not be externally measurable. Routing metrics include number of **Announced Routes, Route Availability,** and **Route Stability,** which measures number of rapid fluctuations in advertised routes. Other routing metrics are **Routing Protocol Convergence Time, Number of Reachable Destinations Covered by a Route,** and **Effectiveness of Route Aggregation** (using CIDR).

4.2 Approach and Methodology

4.2.1 Black-box Approach

Performance metrics include some measurable quantities and characteristics that are visible to the users, and some that are completely internal to the ANX CSP. While the ANX CSP is certainly expected to actively monitor its own internal performance, the ANX certification requirements adopt a *black-box* approach, where the metrics and requirements are usually in terms of properties observable from outside the ANX CSP network. In addition to the measurements taken by the ANXO, the ANX CSP will take similar measurements and provide summaries to the ANXO. These are still "black-box" in the sense that the test points are located at the edges or outside of the ANX CSP network.

A very generic description of a test point is that it is an IP host attached to the ANX network running some IP performance measurements that comply with one or more of the IP-level performance measurement requirements described in this section. A test point could be permanently or temporarily attached to the ANX network, such as tests points configured at the

ANXO OC or within an ANX CSP network, versus test points at an ANX Subscribed TP network temporarily attached by the ANXO.

IP level performance measurements are usually carried out between two test points, one acting as the sender or source and the other acting as the receiver or destination. It is difficult to provide a single generic IP performance testing model to measure all the IP performance metrics defined in this section, but the intent is to describe basic performance tests representative of the applications which ANX Subscribed TPs commonly use and the service that ANX CSPs are expected to provide to them.

Section 4.2.2 describes possible locations for such test points, and Section 4.2.3 provides possible basic test scenarios that serve the purpose of measuring the service quality, in terms of performance, that an ANX CSP provides to an ANX Subscribed TP.

4.2.2 Location of Test Points

Measurements of performance metrics may involve several types of test end points in the ANX network. These include hosts at the ANX Subscribed TP sites, at "dummy" ANX Subscribed TP sites provided by the ANX CSP, test points provided by the ANXO at points where ANX CSPs interconnect (such as Exchange Points or Private Interconnects between ANX CSPs), and at the ANXO Operations Center, which is connected to ANX CSPs' networks and the ANX CEP.
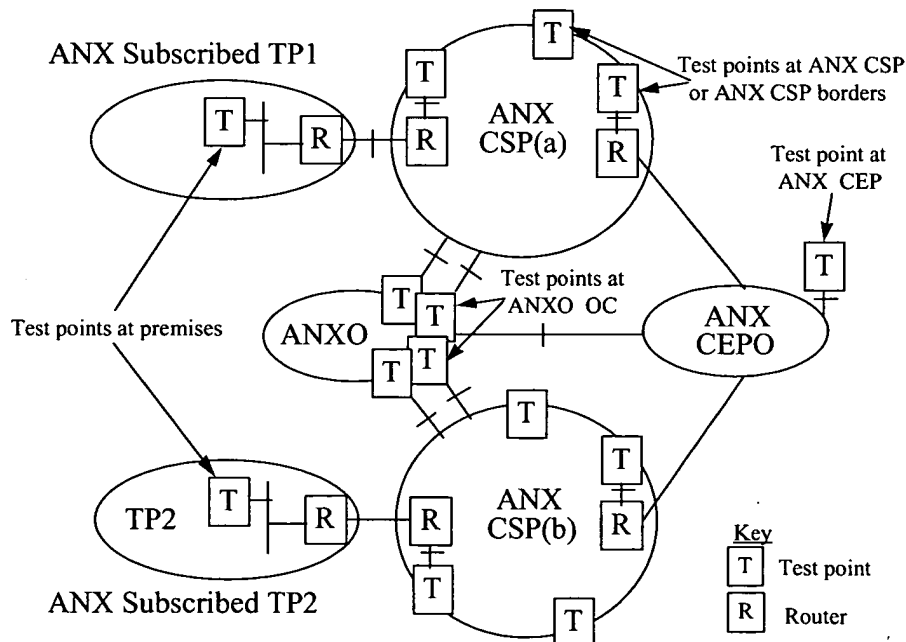
Figure 4-1: Performance Measurement Architecture

4.2.3 Basic Test Scenari_s

There are several test scenarios that can be applied to measure the average performance that an ANX Subscribed TP would observe, in terms of basic parameters of throughput, loss, and delay. Some basic scenarios that will be used in ANX Release 1 are listed and illustrated below.

1. **Scenario 1:** Performance tests that the ANXO would run from a source test point on the ANX Subscribed TP site (with dedicated access to the ANX CSP) to a destination test point on the ANX CSP network. The destination test point could be on the border router of the ANX CSP that terminates the access link, or on an another ANX CSP router where ANX Traffic from many ANX Subscribed TPs merge. Figure 4-2 illustrates this scenario where the access link would generally be the bottleneck link over the end-to-end path.
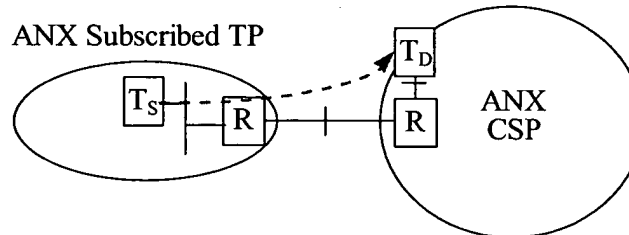
Figure 4-2: Performance Test Scenario 1: From an ANX Subscribed TP Site to an ANX CSP Border

These type of tests help measure the average performance that an ANX Subscribed TP would observe directly. However, since the number of ANX Subscribed TPs are expected to be on the order of thousands, it is impractical to schedule long-term and periodic tests from the complete population of the ANX Subscribed TP sites. Timing and location of these type of tests will be randomly scheduled by the ANXO, as part of a random checking of ANX CSPs, or for trouble shooting purposes, in collaboration with ANX Subscribed TPs. These type of tests would also have to be completed in a limited number of hours due to the time and access restrictions the ANXO would have at an ANX Subscribed TP site.

Scenario 1 type of tests will be carried out by the ANXO from a source test point attached to the customer premises router outside the IPSec gateway/firewall of the ANX Subscribed TP enterprise network, as a common practice.

2. **Scenario 2:** Performance tests that an ANX CSP would run from a source test point on a border router of the ANX CSP that interfaces with other ANX CSP networks (bilateral or at an ANX CEP), to a destination test point at the access portion of an ANX Subscribed TP network (in practice, the ANX Subscribed TP premises router that interfaces with the ANX CSP network, which is maintained by the ANX CSP and which is outside the ANX

Subscribed TP's IPSec gateway/firewall). Figure 4-3 illustrates this scenario where the access link would generally be the bottleneck link over the end-to-end path.
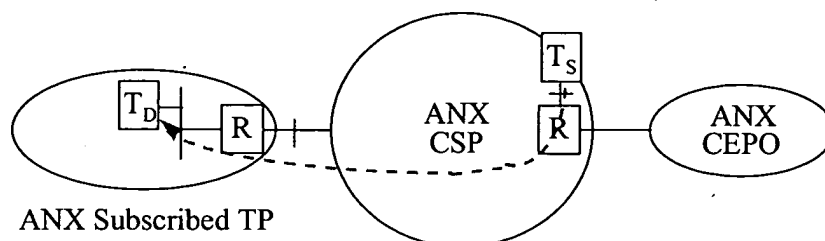
Figure 4-3: Performance Test Scenario 2: From an ANX CSP Border with Other ANX CSPs to an ANX Subscribed TP Site

These type of tests also help measure the average performance that an ANX Subscribed TP would see. However, the coverage of the end-to-end path is different than in the above scenario. The end-to-end path includes the ANX CSP backbone and the ANX Subscribed TP access network. ANX CSPs are expected to perform these type of tests to a subset of their customers' sites, on a periodic basis. Due to periodicity over a long term, these tests would be statistically more significant in representing the average performance an ANX Subscribed TP would see.

Note that the tests are carried out in the reverse direction in these set of tests than in the above scenario. The direction of the tests does not matter however, since the access link capacity is the determining factor for the test results. The primary reason for picking the reverse direction for the ANX CSP-run tests is to minimize the number of source test points that the ANX CSP has to administer, thus to limit the performance testing costs. This approach also allows scaling of the tests proportionally with the ANX customer base of the ANX CSP.

3. **Scenario 3:** Performance tests that the ANXO would run from a source test point at the ANXO OC or attached to the ANX CEP, to a destination test point at the access portion of an ANX Subscribed TP network(in practice, the ANX Subscribed TP premises router that interfaces with the ANX CSP network, which is maintained by the ANX CSP and which is outside the ANX Subscribed TP's IPSec gateway/firewall). Figure 4-4 illustrates this scenario where the ANX Subscribed TP access link may or may not be the bottleneck link over the end-to-end path. (The link between the ANX CEP and the source test point, whether colocated at the ANX CEPO site or placed at the ANXO OC, might be a slower speed link than the ANX Subscribed TP access link in some cases, depending on the relative link speeds.)
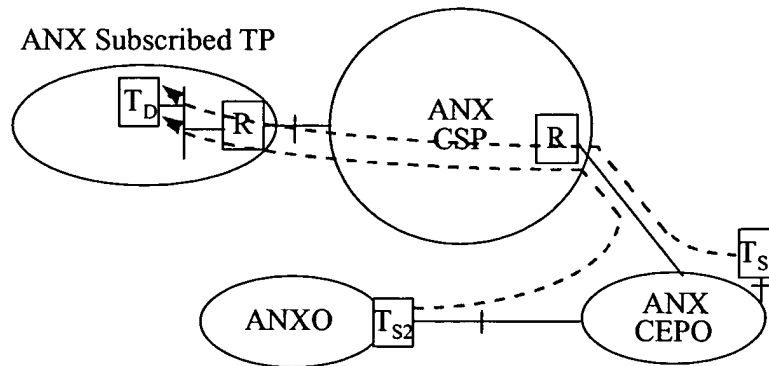
Figure 4-4: Performance Test Scenario 3: From ANXO OC or ANX CEPO Site to an ANX Subscribed TP Site

These type of tests are also useful, although they may not measure the direct performance that an ANX Subscribed TP would see, if the ANXO-ANX CEP link is slower than the ANX Subscribed TP access link. In such cases, the performance can be extrapolated, or estimated by multiplying the test results by the ratio of the ANX Subscribed TP access link speed to the ANXO-ANX CEPO link speed. The benefit of these tests is that they can have the same long-term periodic nature that is applicable to ANX_CSP tests, and provide ANXO with a statistically significant way of measuring the performance from its OC. These tests also add the ANX CEP into the end-to-end path which may be helpful in identifying congestion problems at the ANX CEP in comparison to the test results of the above scenario. Alternatively, Scenario 3 type of tests can be terminated within the ANX CSP network, to solely check the performance of the ANXO-ANX CSP connection through the ANX CEPO.

4. **Scenario 4:** Performance tests that the ANXO would run from a source test point at the ANXO OC to a destination test point on the ANX CSP network (e.g. reachable via dialup). Figure 4-5 illustrates this scenario where the access link would be the bottleneck link over the end-to-end path.
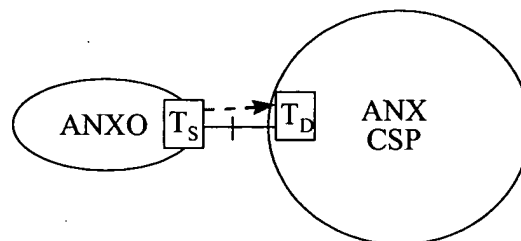
Figure 4-5: Performance Test Scenario 4: From ANXO OC to an ANX CSP Network

These type of tests are useful in initial performance testing interfacing of an ISP, that applied for ANX Certification Assessment, with the ANXO. The test direction may be reversed in order for the ANX CSP Applicant to experience the ANX performance testing methodology and tools and to compare results with the results of the ANXO-run tests. These type of tests may also be used by the ANXO during the long-term Certified State of an ANX CSP, to emulate one of its dialup customers, and to check the average performance dialup customers would typically see.

Scenarios 1, 3 and 4 above require some small participation by the ISPs/ANX CSPs as they need to provide destination test points within their networks to enable corresponding types of tests. These requirements are provided by means of the Test Termination metric in Section 4.3.1.

Scenario 2 above describes the performance tests to be specifically run by the ANX CSPs. Location and testing capability requirements are provided by means of the Network Edge-to-Edge Testing Metric in Section 4.3.1, and the requirements regarding the actual test parameters and criteria are provided by the relevant metrics - Throughput, File Transfer Delay, Packet Loss Rate and Edge-to-Edge Packet Latency, in Section 4.3.2. Note that these four metrics are ANX Certification Verification tripwire metrics as specified in Section 1.4.1.

For Scenario 2 and 3 types of tests, some small participation by the ANX Subscribed TPs is required as they need to provide destination test points over their CPE routers (outside their IPSec gateway/firewall). Likewise, Scenario 1 type of tests requires ANX Subscribed TP's agreement/collaboration in order for the ANXO to carry out performance tests from the ANX Subscribed TP site into the ANX CSP network.

Performance measurements for ANX Release 1 have been instrumented to perform Throughput, File Transfer Delay, and Packet Loss Rate measurements within the same suite of tests in order to minimize the test traffic in the ANX network. A performance test tool specifically designed to meet the specified requirements for these metrics and to be used by ANXO is made available at the ANX Network Accessible ANXO web site for retrieval and use by ANX CSP's to relieve them from the burden of modifying available performance tools, or designing new tools to meet the specified ANX performance test requirements.

Moreover, performance measurements for ANX Release 1 have been instrumented to simplify the destination test point to the extent possible to eliminate the need to administer separate host devices for sinking test traffic. All what is required for a destination test point is to turn the TCP discard socket option (well-known port 9) on, which could be implemented directly on the destination routers. This helps reduce testing costs significantly. IP access list filters should be implemented on these routers to assure test access by only authorized parties (i.e. ANXO, ANX CSP that the ANX Subscribed TP buys ANX Network Service from, or ANX Subscribed TPs that the ANX CSP provides ANX Network Service to).

4.2.4 Approach on Performance Testing

In addition to the requirements that ANX CSPs will run performance tests as described in Scenario 2 above and according to the requirements specified in the latter part of this section, the ANXO will run the Scenarios 1, 3 and 4 type of tests specified above as necessary, mostly for routine spot checking or specific troubleshooting. In addition, initial performance tests for an ANX CSP may be run at the time of ANX Certification Assessment period (as in Scenario 4).

As the number of ANX Subscribed TPs grows, the testing policy will become statistical rather than comprehensive. These tests will be made to resemble ANX Subscribed TP application traffic to the extent practical. ANX CSPs can expect such tests to take place during the busiest portion of normal business days. All ANX performance requirements are expected to be met at all times.

The fundamental performance tests (loss, delay, throughput) all follow the same basic methodology of a monitored file transfer. The ANX performance testing may evolve to include passive "probe" devices, that monitor user traffic as it passes through access links or other points. However, such tests are not contemplated in this document.

4.2.5 Measurement Methodology

The measurement of metrics in this section follow one of several methodologies. For most fundamental performance metrics, measurements are based on large file transfers, which resemble common CAD-type ANX Subscribed TP applications. The Criteria are quantitative bounds on worst-acceptable performance. Some other requirements seek to ascertain that the ANX CSP is following good practice, and only require the ANX CSP to state that they follow the guideline, or to state in some detail how they meet the requirement. A small number of objectives are given where the stated goal is good practice, but there are significant exceptions, so it would be difficult to state the desired behavior as a general requirement.

The measurement approach for these metrics is:

1. The ANX CSP perform periodic tests on these metrics. The ANXO also runs a combination of tests for the purposes of random spot checking and/or trouble-shooting.

2. The ANX CSP provides the ANXO periodically with the test statistics.

3. The ANXO analyzes the combined test results.

4.2.6 TP Access Capacity and Limitation of ANX CSP Responsibility

The access link to an ANX Subscribed TP is dimensioned according to the service purchased from the ANX CSP. Therefore, if performance problems arise because the access capacity purchased is insufficient for the ANX Subscribed TP's traffic, the ANX CSP shall not be held in

violation of performance metrics that depend on the access link behavior, if the ANX CSP can demonstrate to the ANXO that the capacity inadequacy is actually the key problem, and the ANX CSP has advised the ANX Subscribed TP of the situation and its consequences in a timely manner.

4.2.7 ANX CEPO Responsibility

For ANX CEPO, the fundamental performance metrics are cell loss and access link utilization. The ANX CEP network property that most significantly influences loss and delay is the relative offered load on links (i.e. switch ports) and switch capacity. The ANX CEPO is responsible for measuring these metrics as specified by the corresponding requirements in this section, reporting them to the ANXO, and informing the ANX CSPs when the average link utilization measurements indicate that the average access link utilization by an ANX CSP exceeds 50% of the interconnection rate.

All performance measurements by the ANX CEPO should be carried out at the cell level (layer 2 measurements) using native switch tools, SNMP-based statistics collection, and ATM cell analyzers. Cell-based traffic analyzers that generate, capture, record, and analyze cell-based traffic could be utilized by the ANX CEPO, if needed. There are also passive monitoring devices that achieve the same or similar measurement goals for limited set of ATM interfaces (such as OC3mon). Use of such devices, although not prohibited, is not required for ANX Release 1.

Therefore, the test points described in the above sections, do not apply to layer 2 performance measurements to be carried out by the ANX CEPs, as they measure IP level performance. Yet, combination of test results described by Scenarios 1, 2 and 3 in perspective, can help identify long-term congestion problems at an ANX CEP, although such a problem should not really be observed if the ANX CSPs and ANX CEPO meet the adequate capacity requirements described in Section 3 and the Access Link Utilization metric requirement of this section.

4.3 ANX Certification Assessment Requirements

4.3.1 Measurement Capability Metrics

[R4-1.: CertAss]   Test Termination Metric

R The ANX CSP **shall** maintain capability to terminate ANXO-originated test traffic (originated from outside its network) within the ANX CSP network. In order to allow ANXO-initiated test traffic to terminate within its network, ANX CSP **shall** provide Test Termination Points (TCP discard service on well-known TCP port 9) to the ANXO. The Test Termination Points **shall** also respond to ICMP messages for ping and traceroute in order for the ANXO Performance Test Tool to test connectivity and measure the number of IP hops prior to execution of performance tests. Such test traffic may originate from:.

1. a test point at the ANXO OC (for Scenario 3 and 4 type of tests described in Section 4.2.3);

2. a test point attached to the ANX CEP (for Scenario 3 type of tests described in Section 4.2.3); or

3. a test point temporarily attached to an ANX Subscribed TP network (outside the IPSec gateway/firewall) which connects to the ANX CSP's network (for Scenario 1 type of tests described in Section 4.2.3); For tests originated from an ANX Subscribed TP site, the Test Termination Points **shall** be chosen to include the ANX Subscribed TP's access link in the source-to-destination test path. The ANX Subscribed TP access router (CPE) is <u>not acceptable</u> as a Test Termination Point.

The *number* of Test Termination Points will generally be far fewer than the number of ANX Subscribed TPs, since tests sent from a large set of ANX Subscribed TPs can all share a common remote test point. The number and location of such Test Termination Points, i.e. destination test points, (relative to ANX Subscribed TPs and ANX CEPs or private interconnects with other ANX CSPs) is left up to the ANX CSP. Test traffic can be assumed to be a transfer of a large file using a TCP/IP based application.

Measurement Technique:

R The ANX CSP Applicant **shall** provide a diagram of its planned ANX network architecture including where ANX Subscribed TP customer premises routers and access links may be, and identify the location and IP address of such Test Termination Points to the ANXO at ANX Certification Assessment.

[R4-2.: CertAss]   Network Edge-to-edge Testing Metric

R The ANX CSP **shall** administer the capability to run packet loss, throughput, file transfer delay and network edge-to-edge packet latency tests between source and destination test points as described in Scenario 2 in Section 4.2.3, and in compliance with all the requirements set forth for ANX Certification Verification, as applicable.

Measurement Technique:

R The ANX CSP Applicant **shall** provide a diagram of its ANX network architecture clearly describing the intended locations and IP addresses of the source and destination test points in compliance with all the requirements set forth for ANX Certification Verification. The connection rates of source test points, and offered customer access rates, **shall** also be indicated. Note that the ANX CSP Applicant will not have any actual ANX Subscribed TP customers until being ANX Certified. For ANX Certification Assessment, the ANX CSP Applicant **shall** provide one source-to-destination path over which to perform the ANX Certification Assessment required performance tests. The source test point **shall** be attached to the router that will be

connected to the ANX CEP. The destination test point **shall** emulate a dummy ANX Subscribed TP site/access router and **shall** be chosen on a separate router or host within the ANX CSP Applicant's network. The source and destination test points **shall** be chosen such that they **shall** be geographically distant from each other. The test points **shall** comply with the corresponding ANX Certification Verification metric requirement as applicable. The ANX CSP Applicant **shall** also provide a schedule describing the starting times of performance tests to run on this source-to-destination path in compliance with the above stated requirements. ANXO may request an alternate location for the destination test point, and an alternate test schedule for the source-to-destination path. The ANX CSP Applicant **shall** agree to carry out throughput, packet loss rate, file transfer delay, and packet latency performance tests (in compliance with the requirements set forth for these metrics) over the final source-destination path and according to the schedule that the ANXO approves. For the use of test tools, see the corresponding requirement for ANX Certification Verification.

[R4-3.: CertAss]   Access Link Utilization Metric

R The ANX CSP **shall** maintain the capability to measure access link/circuit utilization statistics for each ANX Subscribed TP it serves, except for dialup access customers, and for each of its ANX CSP-ANX CSP bilateral connections.

R Similarly, ANX CEPO **shall** maintain the capability to measure access link/circuit utilization statistics for each ANX CSP it serves.

Measurement Technique:

R The ANX CSP/ANX CEPO Applicant **shall** describe this capability to the ANXO for ANX Certification Assessment and **shall** commit to provide to the ANXO, graphs of the access link utilization statistics and the average access link utilization measured over the last month on each ANX CSP-ANX CSP and ANX CSP-ANX CEPO connection on a monthly basis. The ANX CSP Applicant **shall** also commit to provide similar statistics on ANX Subscribed TP access links for the past 3 months, if and when specifically requested by the ANXO on a specific ANX Subscribed TP access link. The access link utilization MIB in the access equipment **shall** be sampled no less often than once per 15 minute time interval.

4.3.2 Fundamental Performance Metrics

[R4-4.: CertAss]   Throughput Metric

Throughput is a measure of the aggregate bandwidth that the ANX Subscribed TP site/ANX CSP site can make use of at any given time. (Note that for an ANX CSP this metric is defined by a specific measurement technique, and does not attempt to predict what throughput the ANX Subscribed TP applications actually *do* get, since that depends on particular implementations of higher-layer protocols.) Equivalently, the throughput metric is the efficiency with which the user

can load its access link, when the access link is the smallest bottleneck in the communications path. We assume that the throughput available to an ANX subscriber can be stated in terms of the access link bandwidth, since there would be no reason for an ANX Subscribed TP/ANX CSP to purchase more access capacity than it could use due to other limiting factors. The term "access link bandwidth" means the raw link bandwidth (e.g., 56 kb/s, 1.544 Mb/s, 45 Mb/s, 155 Mb/s, etc.) that the ANX Subscribed TP/ANX CSP is acquiring from its provider (i.e., an ANX CSP for the ANX Subscribed TP, an ANX CEPO for the ANX CSP or the link to another ANX CSP for private bilateral connections).

R The throughput for an ANX Subscribed TP/ANX CSP site **shall** not be less than the quantity (access link bandwidth * C_Th/ F_LL). If fractional rate service is provided (e.g., fractional T1) then the bandwidth figure **shall** be adjusted proportionally. The quantitative Criterion for the throughput metric is C_Th = 0.50.

The value of F_LL (a factor which accounts for link layer protocol overheads) depends on the link-layer access link technology as follows:

Link Layer	F_LL
ATM	1.25
Frame Relay	1.05
SMDS	1.25
PPP/T1	1.05
All Others	1.05

Table 4-1: Link Layer Protocol Overhead Factor (F_LL)

Throughput values are always computed in terms of bits of IP packets (including TCP payload and TCP/IP headers) per second. Measurements may need to be adjusted to compensate for link-layer headers. The capacity consumed by the link layer is taken into account by the use of the appropriate F_LL divider indicated above.

Measurement Technique:

R The ANX CSP Applicant **shall** perform periodic throughput tests, collect a month's worth of data and report test results (i.e., average throughput over all file transfers) and raw test data (i.e., throughput of each file transfer) to the ANXO for ANX Certification Assessment. The test for throughput **shall** consist of a series of large file transfers using TCP distributed over the month,

to be carried out by the ANX CSP Applicant between a given source and a destination test point, as specified by the "network edge-to-edge testing metric". The throughput tests **shall** conform to the following requirements:

1. The value of throughput **shall** be computed in bits/sec (for easy comparison against the link access speed) as:

    throughput = ((8 * sum of number of IP bytes sent)/sum of time intervals for each file transfer) bits per second.

2. For ANX CSPs/ANX CSP Applicants testing throughput within their networks, the time interval between each file transfer **shall** be at most 24 hours (i.e. frequency of file transfers **shall** be at least 1 per day). ANX CSPs/ANX CSP Applicants **shall** calculate and report throughput averaged over a month's worth of file transfer measurements, for the previous month.

3. The size of the file transferred in an individual TCP file transfer **shall** be at least 30 Mbytes, and not more than 100 Mbytes when the ANX access link capacity is 1.544 Mb/s or larger. For slower speed access links such as 56 kb/s or fractional T1, the test files **shall** be at least 1 Mbyte.

4. Thus, the sums **shall** be taken over the smallest set of most recent test file transfers for which the number of total bytes (for the set of file transfers) is greater than 900 Mbytes for DS1 or higher access link speeds. For slower access links, the total bytes **shall** be taken at 30 Mbytes. Appropriate total byte adjustments are allowed for 28- or 29-day months of the year to allow day-to-day uniformity of file transfer tests to be carried out by ANX CSPs/ANX CSP Applicants (i.e., 840 or 870 Mbytes for DS1 and higher speed links, and 28 or 29 Mbytes for lower speed links).

    Note that for ANXO-run throughput tests at ANX Subscribed TP sites, the total test duration will not be a month, therefore the interval between file transfers will be much smaller than the maximum period of 24 hours[2] in order to complete a throughput measurement within the same day or so. However, such measurements will satisfy the same metric requirements regarding file sizes and total bytes.

5. The size of the IP packets comprising the test **shall** be between 500 and 700 bytes. The packets for a single file transfer should be uniform in size and the IP packet size **shall** be noted as part of the record of the test.

6. Immediately before and after each file transfer composing the test, the test application **shall** query the "total octets out" MIB of the ANX Subscribed TP access link router, and **shall** record the time. Total octets are contributed by the test traffic as well as the non-

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[2] For all file transfer tests measuring throughput, or PLR, or file transfer delay, the minimum interval between the starting times of file transfers should be larger than the Numerical Target estimated for file transfer delays, as provided in the file transfer delay metric requirements.

test, production traffic (i.e. ANX Traffic). A simple calculation of the access link utilization by the file transfer is given by the total bytes transmitted during the file transfer divided by the difference in the octet count. If this utilization value is greater than or equal to C_Th, then the throughput requirement is met. In the case where the throughput measured by the test application contributes to lower than 50% utilization, then the background ANX Traffic from the ANX Subscribed TP(s) makes up the difference.

7.   Throughput tests may be taken across any portion of the ANX Network, however, for ANX CSPs/ANX CSP Applicants, they **shall** satisfy the requirements set forth in this document by the "network edge-to-edge testing metric". Metric values **shall** always be computed from results of file transfers occurring with identical endpoints. Test points for ANXO-run tests may include any test point provided by the ANXO located at an ANX Subscribed TP site, at the ANXO Operations Center, or attached to the ANX CEP.

8.   For any throughput test that traverses facilities that are not directly controlled by a single ANX CSP/ANX CSP Applicant, the tests **shall** be adjusted or interpreted appropriately to account for those facilities (their access/backbone bandwidth, etc.). For example, if a test file transfer traverses a LAN and host operated by an ANX Subscribed TP on one side and a router, LAN and host operated by the ANXO on the other side, the person performing the test **shall** perform the tests with the knowledge of the slowest speed (bottleneck) link in the path, and **shall** ascertain that the conditions of those facilities contribute insignificant impairment compared to that due to the ANX CSP/ANX CSP Applicant under test. The information that determines this condition **shall** be noted as part of the test record.

9.   If the access router imposes any additional overhead for IP Security (IPSec) on test packets, the throughput test results **shall** be adjusted appropriately. It is preferable to have test applications and test packets use IP Security to minimize attacks on test systems and to take the opportunity to obtain results that are representative of what an ANX Subscribed TP would experience.

[R4-5.: CertAss]   Packet Loss Rate Metric

R   Packet loss rate (PLR) is a measure of the relative frequency of packets which are not successfully transmitted across the ANX network. The packet loss rate for the ANX **shall** not exceed 0.1% (i.e., one packet in one thousand). The quantitative Criterion for the PLR metric is C_PLR = 0.001. The value of packet loss rate **shall** be computed as:

PLR = (number of packets sent - number of packets necessary)/number of packets sent)

The term "number of packets necessary" means the number of packets that would complete the transmission of the test file if none were lost.

Loss measurements are always computed in terms of IP packets, and not higher layer PDUs (such as the IP or TCP payload or user data), or lower layer PDUs (such as ATM cells or Ethernet packets). This condition applies because the IP packet is the lowest-level PDU transported from one ANX boundary to another. The packet loss metric is computed in terms of packets and not bytes, because the importance of the data transmitted by different applications, and the impairment of QoS caused by a packet loss, is not in proportion to the size of the packet. For example, a file transfer may use 1500-byte packets while a Telnet application uses approximately 50-byte packets. The loss of a packet causes a retransmission in each case, but the Telnet user may be more sensitive to the effect of higher packet loss than the file transfer user.

Measurement Technique:

R The ANX CSP Applicants **shall** perform packet loss rate tests periodically, collect a month's worth of data and report test results (i.e., average packet loss rate over all file transfers) and raw test data (i.e., packet loss rate of each file transfer) to the ANXO for ANX Certification Assessment. The test for packet loss rate **shall** consist of a series of large file transfers using TCP distributed over the month, and **shall** be executed by the ANX CSP Applicants between a given source and a destination test point, to be repeated for all the paths specified by the "network edge-to-edge testing metric". The packet loss rate tests **shall** conform to the following requirements:

1. The value of packet loss rate **shall** be computed as:

    PLR = (sum of number of packets sent - sum of number of packets necessary) / sum of number of packets sent.

2. For ANX CSPs/ANX CSP Applicants testing PLR within their networks, the time interval between each file transfer **shall** be at most 24 hours (i.e. frequency of file transfers **shall** be <u>at least 1 per day</u>). ANX CSPs/ANX CSP Applicants **shall** calculate and report PLR averaged over a month's worth of file transfer measurements.

3. The size of the test files transferred as part of the PLR test **shall** be at least <u>30 Mbytes</u>, and not more than 100 Mbytes when the ANX access link capacity is 1.544 Mb/s or larger. For slower speed access links, the test files **shall** be at least <u>1 Mbyte</u>.

    a) The sums **shall** be taken over the smallest set of most recent test file transfers for which the total number of packets for all test files is greater than 100*(1/C_PLR) for access link speeds of DS1 or higher. This allows for a high degree of confidence in the accuracy of the test results.

    b) For slower speed links, such as 56 Kbps, or fractional T1, the total number of packets are allowed to be half as many, in order to avoid lengthy file transfers over slow links.

Note that the file transfer tests used to measure throughput averaged over a month by an ANX CSP/ANX CSP Applicants can be used to also measure PLR, while always satisfying the requirements of the PLR metric. This helps reduce redundant test traffic in ANX CSP network to the benefit of all ANX Participants.

Note that for ANXO-run throughput tests at ANX Subscribed TP sites, total test duration will not be a month, therefore the interval between file transfers will be much smaller than the maximum period of 24 hours in order to complete a PLR measurement within the same day or so. However, such measurements will satisfy the same metric requirements regarding file sizes and total number of packets.

4. The size of the IP packets comprising the test **shall** be between <u>500 and 700 bytes</u>. The packets for a single file transfer should be uniform in size and the IP packet size **shall** be noted as part of the record of the test.

5. Immediately before and after each file transfer composing the test, the test application **shall** query the "total octets out" MIB of the ANX Subscribed TP access link router, and **shall** record the time. Total octets are contributed by the test traffic as well as the non-test, production traffic (i.e. ANX Traffic). A simple calculation of the access link utilization by the file transfer is given by the total bytes transmitted during the file transfer divided by the difference in the octet count. One minus this value gives the access link utilization of the background ANX Traffic. If the average background ANX Traffic access link utilization value over all file transfers is greater than 50%, then the PLR Criterion may be relaxed as described in the table provided below.

    a) Note, if the ANX Traffic access link utilization during a particular file transfer measured by this method exceeds 70%, the particular file transfer **shall** not be used to compute PLR and the total number of packets needed to assure confidence in accuracy of test results (See 3.a above). Consistent measurements of very high access link utilization may indicate that the ANX Subscribed TP has insufficient access capacity.

    b) All ANX Traffic access link utilization values measured over individual file transfers **shall** be used in calculating the average ANX Traffic access link utilization (See Table 4-2) for the complete test.

6. PLR tests may be taken across any portion of the ANX Network, however, for ANX CSPs/ANX CSP Applicants, they **shall** satisfy the requirements set forth in this document by the "network edge-to-edge testing metric". Metric values **shall** always be computed from results of file transfers occurring with identical end points and ANX CSPs/ANX CSP Applicants serving those end points.

7. For any PLR test that traverses facilities that are not directly controlled by a single ANX CSP/ANX CSP Applicant, the tests **shall** be adjusted or interpreted appropriately to account for those facilities. For example, if a test file transfer traverses a LAN and host

operated by an ANX Subscribed TP on one side and a router, LAN and host operated by the ANXO on the other side, the person performing the test **shall** perform the tests with the knowledge of the slowest speed (bottleneck) link in the path, and **shall** ascertain that the conditions of those facilities contribute insignificant impairment compared to that due to the ANX CSP/ANX CSP. Applicant under test. The information that determines this condition **shall** be noted as part of the test record.

Average ANX Traffic (Non-test Traffic) Access Link Utilization	C_PLR
0-50%	0.001
50-70%	0.01
70%+	invalid test

Table 4-2: Packet Loss Ratio Criterion Adjusted to Average ANX Traffic Access Link Utilization

[R4-6.: CertAss]   Cell Loss Rate Metric

R   ANX CEPO **shall** have a cell loss rate of no greater than one cell in ten million under the entire range of operational load.

Measurement Technique:

R   For ANX Certification Assessment, the ANX CEPO Applicant **shall** collect per port and per PVC cell loss statistics on the ANX CEP switch, for each ANX CSP access port and each unidirectional PVC used for ANX Traffic between ANX CSPs. SNMP or other statistics collection means can be utilized. Measurements **shall** be based on sampling at 15 minute time intervals. The ANX CEPO Applicant **shall** describe this capability to the ANXO and **shall** provide average per port/per PVC cell loss rates measured over a month for all access links and ANX Connections prior to ANX Certification Assessment.

[R4-7.: CertAss]   File Transfer Delay Metric

This delay metric is a measure of the time taken to transfer data across the ANX from a specified source test point to a destination test point. The delay metric is compared to a simple numerical target. There are, however, legitimate cases where this target will not be met, and a more complex target may be computed that accounts for several components: propagation delay, serialization delay (depending on the speed of the link connecting to the test host and/or access link rate), per-IP hop processing delay, and delay due to TCP retransmissions. Measuring the

delay of a file transfer is preferable to measuring delays of individual packets, since the distribution of packet delays can be complex, and small sets of data points can be misleading.

R The delay metric Criterion C_D is compared to at least the most recent 30 file transfer delay measurements, which are the same file transfers used to measure throughput and packet loss rate metrics. Of these, 90% of the measured delays **shall** be less than C_D. The delay values of tests with delays higher than C_D **shall** be noted as part of the test record. File Transfer Delay Metric measurements **shall** conform to the following requirements:

1. The delay metric Criterion C_D **shall** be given by the larger of a Numerical target, NT, and the quantity

$$1.20 * (\{\text{file size} / \text{minimum link rate}\} + 2 * (\text{n\_hops} * \text{D\_hop} + \text{propagation delay}))$$

where the Numerical targets (NTs) for 1 Mbyte and 30 Mbyte files for given link rates are provided in the following table considering worst case link overheads (F_LL=1.25) and 512 Byte TCP MSS (which corresponds to a 552 Byte IP packet). {...} stands for file size and link rate values being adjusted for transmission packet size and link layer overhead factor (F_LL) as described below. Note that NT roughly accounts for the transmission delay and is equivalent to the first term in {...} in the formula above, if the packet size and F_LL parameters match.

$$NT = [(\text{File Size} / \text{minimum link rate}) * (552/512) * (F\_LL/C\_Th)]$$

a) The term "minimum link rate" means the smallest rate of the following: the link between the test point and the access demarcation, the access link itself, and the corresponding test point link and access link at the remote (terminating) test point. In a well-designed test, the access link of the ANX Subscribed TP under test is the smallest bottleneck. When this is not the case, the delay requirement must be computed in terms of the smallest bottleneck rate.

b) The file size **shall** always be computed in terms of bits of IP packets necessary for the file transfer (i.e. multiply the file size by (IP bits + TCP/IP header)/IP bits).

c) Each link rate **shall** be derated for the link layer overhead according to the table given for the throughput metric and the throughput Criterion (i.e., multiply the link rate by C_Th/F_LL).

d) The parameter n_hops is the number of IP hops (i.e., network elements that normally decrement the IP TTL field). For ANX Release 1 the number of hops within the ANX CSP network **shall** be smaller or equal to 4.

e) The allowance of delay per IP hop is D_hop = 30 msec.

f) The propagation delay is computed as the physical terrestrial surface distance between the two test points multiplied by 5 usec/km. (This figure is the speed of light in glass fiber, and is approximately correct for coax cable as well.)

Minimum Link Rate	NT for 1 Mbyte File	NT for 30 Mbyte File
56 Kbps	385 sec	-
128 Kbps	170 sec	-
T1	-	412 sec
Ethernet	-	64 sec
DS3	-	14 sec
OC3	-	4 sec

Table 4-3: Numerical Transmission Delay Targets (NT) for Various Link Rates

Measurement Technique:

R The ANX CSP Applicant **shall** perform file transfer delay tests, collect a month's worth of data and report test results (i.e., average file transfer delay over all file transfers) and raw test data (i.e., file transfer delay of each file transfer) to the ANXO for ANX Certification Assessment. The test for delay **shall** consist of a series of file transfers using TCP distributed over the month, which are also used to measure throughput and packet loss rate and executed by the ANX CSP Applicant between a given source and a destination test point. The file transfer delay measurements **shall** be repeated for all the paths specified by the "network edge-to-edge testing metric as is the case for throughput and packet loss rate metrics. The set of at least 30 most recent file transfers (28 or 29 file transfers are allowed for 28- or 29-day months) **shall** be compared to the delay Criterion and the measurement methodology **shall** conform to the following requirements:

1. The value of delay **shall** be computed as the full duration of the TCP session required to transfer the file, including the TCP initial and closing handshake packets.

2. For ANX CSPs/ANX CSP Applicants testing file transfer delay within their networks, the time interval between each file transfer **shall** be at most 24 hours (i.e. frequency of file transfers **shall** be at least 1 per day). ANX CSPs/ANX CSP Applicants **shall** calculate and report file transfer delay averaged over a month's worth of file transfer measurements.

3. The size of the files transferred as part of the delay test **shall** be <u>1 Mbyte</u> for link speeds less than DS1, and <u>30 Mbytes</u> for link speeds DS1 and above (variation within 10% is acceptable).

   Note that the file transfer tests used to measure throughput, or packet loss rate can also be used to measure file transfer delay, while always satisfying the requirements of the file transfer delay metric. This helps reduce redundant test traffic in ANX CSP's/ANX CSP Applicant's network to the benefit of all ANX Participants.

   Also note that for ANXO-run throughput tests at ANX Subscribed TP sites, total test duration will not be a month, therefore the interval between file transfers will be much smaller than the maximum period of 24 hours in order to complete a file transfer delay measurement within the same day or so. However, such measurements will satisfy the same metric requirements regarding file sizes and number of file transfers.

4. The size of the IP packets comprising the test **shall** be between <u>500 and 700 bytes</u>. The packets for a single file transfer should be uniform in size and the IP packet size **shall** be noted as part of the record of the test.

5. Immediately before and after each file transfer composing the test, the test application **shall** query the "total octets out" MIB of the ANX Subscribed TP access link router, and **shall** record the time. Total octets are contributed by the test traffic as well as the non-test, production traffic (i.e. ANX Traffic). A simple calculation of the access link utilization by the file transfer is given by the total bytes transmitted during the file transfer divided by the difference in the octet count. One minus this value gives the access link utilization of the background ANX Traffic. If the average background ANX Traffic access link utilization value is greater than 50%, then the delay Criterion may be relaxed as specified by the following table.

   a) Note, if the utilization measured by this method exceeds 70%, the test **shall** not be used to compute the file transfer delay metric. Consistent measurements of very high access link utilization may indicate that the ANX Subscribed TP has insufficient access capacity.

6. Delay tests may be taken across any portion of the ANX Network, however, for ANX CSPs/ANX CSP Applicants, they **shall** satisfy the requirements set forth in this document by the "network edge-to-edge testing metric". Metric values **shall** always be computed from results of file transfers occurring with identical end points and ANX CSPs/ANX CSP Applicants serving those end points.

7. For any delay test that traverses facilities that are not directly controlled by a single ANX CSP/ANX CSP Applicant, the tests **shall** be adjusted or interpreted appropriately to account for those facilities. For example, if a test file transfer traverses a LAN and host operated by an ANX Subscribed TP on one side and a router, LAN and host operated by the ANXO on the other side, the person performing the test **shall** perform the tests with

the knowledge of the slowest speed (bottleneck) link in the path, and **shall** ascertain that the conditions of those facilities contribute insignificant impairment compared to that due to the ANX CSP under test. The information that determines this condition **shall** be noted as part of the test record.

ANX Traffic (Non-test Traffic) Access Link Utilization	C_D (for a given Link Rate)
0-50%	NT (See Table 4-3)
50-70%	2 NT (See Table 4-3)
70%+	invalid test

Table 4-4: Delay Criterion Adjusted to Link Utilization

[R4-8.: CertAss]   Network Edge-to-edge Packet Latency Metric

Although not always accurate (when the forward and reverse paths are not symmetrical), approximating the one-way latency by half the round trip delay **shall** be allowed for ANX Release 1 for minimizing testing costs for ANX CSPs. Worst case round trip packet latency can be measured using ping tests carried out at several busy hours during several days, averaging the results over several tests, and dividing the average round trip value by two. Averaging the results, rather than analyzing the maximum delay measurements is a better approach for long term performance trend analysis since few skewed maximum delay measurements will not accurately represent the network performance.

R   Network edge-to-edge packet latency is defined as the one-way delay of a packet to traverse an ANX CSP network. The latency for a small 64-byte packet measured from edge-to-edge in an ANX CSP network (including the edge routers and the access links) **shall** not exceed 125 ms.

Measurement Technique:

R   For ANX Certification Assessment, ANX CSPs/ANX CSP Applicants **shall** confirm to the ANXO their ability to meet this requirement and their ability to collect statistics on this metric between the source and destination test points described by the network edge-to-edge testing metric. For the ANX Network, edge-to-edge packet latency tests **shall** be carried out during a busy hour. ANX CSPs/ANX CSP Applicants **shall** perform at least one hundred (100) 64-byte ping measurements at a busy hour every day, and **shall** repeat the same measurements for a month, for the source-destination path specified by the network edge-to-edge testing metric. Then the average round trip delay calculated over all the measurements within the month **shall**

be halved to estimate one-way packet latency. ANX CSP/ANX CSP Applicant **shall** report to the ANXO the average round trip delay, and minimum and maximum values for each test, in addition to the average one-way packet latency calculated over all the tests. . More appropriate one-way latency measurements are allowed, if the ANX CSP/ANX CSP Applicants have the means to measure one-way delay directly.

4.3.3 Equipment Configuration/Utilization Metrics

[R4-9.: CertAss]   Performance Data Tracking Metric

R   Routers and switches have load and error tracking capability (e.g. packet counts over a defined time interval, packet drop counts, invalid CRC counts, etc.). The ANX CSP/ANX CEPO **shall** have the capability to track performance data for the nodes or network elements within its network.

Measurement Technique:

R   The ANX CSP/ANX CEPO Applicant **shall** describe the routine procedures they follow to record, monitor and trigger alarms (or other action) based on these statistics. The ANXO **shall** verify the adequacy of these procedures.

4.3.4 Dialup Modem Pool Metrics

[R4-10.: CertAss]   Dialup Blocked Call Ratio Metric

R   If an ANX CSP provides dialup service, ANX CSP **shall** allocate adequate dialup port capacity so that the ratio of blocked to attempted calls **shall** not exceed 5% during any hour of the day. This includes the call blocking that can happen at a local carrier that provides dialup access for the ANX CSP.

Measurement Technique:

R   For ANX Certification Assessment, the ANX CSP Applicant **shall** commit to provide to the ANXO blocked call ratio statistics (#of blocks / # of attempts), including the count of call attempts, completions and blocks (# of completions + # of blocks = # of attempts) for a busy hour each day, for each hunt group directory number provided for accessing the ANX Network. For the ongoing ANX Certification Verification process, the ANX CSP **shall** be liable for collecting dialup call statistics for the same busy hour (for a given directory number) each day.

1.   In achieving and measuring this Criterion, the ANX CSP will need to cooperate with any local carrier(s) that it uses to provide dialup access. If dialup statistics are not available from the local carrier(s), the ANX CSP **shall** actively collect blocked call ratio statistics (using internal or external resources) itself, for each hunt group directory number used for

accessing the ANX network, by dialing each number at least 6 times at a given busy hour, every day for the reporting period.

2.   If the ANX CSP fails this metric because of faults, inefficiencies in the LEC network, the ANX CSP **shall** provide proof of adequate dialup port capacity and LEC-based problems causing call blocking in order to avoid the probation state.

3.   The ANXO may request measurements to be performed at a different hour, upon which the ANX CSP **shall** comply with.

4.4 ANX Certification Verification Requirements

ANX Network Service is expected to operate at all times with performance consistent with the ANX Certification Assessment test criteria. As part of the ongoing ANX Certification Verification process, the ANX CSP is expected to work proactively with its client ANX Subscribed TPs to investigate and address complaints of poor quality in the ANX CSP's network.

The ANXO will conduct measurements of ANX performance on an ongoing basis to test for conformance to the certification requirements. Upon indication of any non-conforming performance, the ANX CSP is expected to work cooperatively with ANXO to identify and resolve any problems. After an initial discussion and/or investigation, the ANXO may repeat any of the performance tests for ANX Certification Assessment in the process of resolving trouble.

4.4.1 Measurement Capability Metrics

[R4-1.: CertVer]   Test Termination Metric

R   The ANX CSP **shall** maintain capability to terminate ANXO-originated test traffic (originated from outside its network) within the ANX CSP network. In order to allow ANXO-initiated test traffic to terminate within its network, ANX CSP **shall** provide Test Termination Points (TCP discard service on well-known TCP port 9) to the ANXO. The Test Termination Points **shall** also respond to ICMP messages for ping and traceroute in order for the ANXO Performance Test Tool to test connectivity and measure the number of IP hops prior to execution of performance tests. Such test traffic may originate from:

1.   a test point at the ANXO OC (for Scenario 3 and 4 type of tests described in Section 4.2.3);

2.   a test point attached to the ANX CEP (for Scenario 3 type of tests described in Section 4.2.3); or

3.   a test point temporarily attached to an ANX Subscribed TP network (outside the IPSec gateway/firewall) which connects to the ANX CSP's network (for Scenario 1 type of tests described in Section 4.2.3). For tests originated from an ANX Subscribed TP site, the

Test Termination Points **shall** be chosen to include the ANX Subscribed TP's access link in the source-to-destination test path. The ANX Subscribed TP access router (CPE) is <u>not</u> <u>acceptable</u> as a Test Termination Point.

The *number* of Test Termination Points will generally be far fewer than the number of ANX Subscribed TPs, since tests sent from a large set of ANX Subscribed TPs can all share a common remote test point. The number and location of such Test Termination Points, i.e. destination test points, (relative to ANX Subscribed TPs and ANX CEPs or private interconnects with other ANX CSP) is left up to the ANX CSP. Test traffic can be assumed to be a transfer of a large file using a TCP/IP based application.

Measurement Technique:

R The ANX CSP **shall** provide an updated diagram of its ANX network architecture including ANX Subscribed TP customer premises routers and access links, and identify the location and IP address of such Test Termination Points to the ANXO, each quarter or when changes occur.

[R4-2.: CertVer]   *Network Edge-to-edge Testing Metric*

R The ANX CSP **shall** maintain the capability to run throughput, packet loss, file transfer delay and network edge-to-edge packet latency tests between source and destination test points as described in Scenario 2 in Section 4.2.3 and in compliance with the following:

1.   The ANX CSP **shall** administer a source test point at each one of its border routers that peers (interfaces) with other ANX CSP's routers, i.e. routers that connect to the ANX CEP, back-up ANX CEP, and at bilateral peering connections. (If the ANX CSP is using a single router to connect to the ANX CEP and the back-up ANX CEP, only one source test point is needed. If two separate routers are used, two source test points are needed. For each new router that provides a bilateral peering connection with other ANX CSPs, a new source test point is needed.)

    a)   Each source test point **shall** connect to its router via an interface representing at least the highest speed ANX Subscribed TP customer access of that ANX CSP, up to and including Ethernet access rates. ANX CSPs which have greater than 10 Mbps access customers (i.e. DS3) may connect their source test points via Ethernet for ANX Release 1.

    b)   Each source test point **shall** be capable of running performance testing software adequate to measure packet loss, throughput, file transfer delay and network edge-to-edge packet latency metrics in compliance with the requirements specified for each of these metrics in this document.

2.   Likewise, ANX CSPs **shall** administer destination test points at a number of ANX Subscribed TP customer premises routers, in proportion to its ANX Subscribed TP customer base. The number of destination test points **shall** be at least 5% of the ANX

Subscribed TPs who connect to the ANX CSP, no more than 20 and no less than 6 unless the ANX CSP has less than 6 customers. The destination test points are required to merely provide ping and traceroute access and perform passive opens of TCP connections (TCP discard service) on well-known TCP port nine, thus could be administered on the router itself rather than an IP host attached to the router. To the extent possible, the destination tests points **shall** be selected such that:

a) they represent the complete range of access rates that ANX Subscribed TPs purchase from that ANX CSP,

b) they are at geographically diverse locations, and

c) the ANX CSP POPs (or border routers that terminate ANX Subscribed TP access links) that serve them are also at geographically diverse locations.

d) The ANX CSPs **shall** inform the ANX Subscribed TPs whose CPEs are chosen to be the destination test points and request a release for running performance tests to their access routers, or alternatively, hosts systems identified by the ANX Subscribed TPs.

3. ANX CSP **shall** run packet loss, throughput, file transfer delay and network edge-to-edge packet latency tests over the path between each source-destination pair. These tests **shall** conform to the requirements set forth for the packet loss, throughput, file transfer delay and network edge-to-edge packet latency metrics described in Section 4.3.2. Note that packet loss, throughput, file transfer delay measurements can be carried out within the same suite of file transfer tests.

a) ANXO makes available an IP performance test tool, designed particularly to run packet loss, throughput, file transfer delay and network edge-to-edge packet latency tests in compliance with the set of requirements specified for each of these metrics, to ANX CSPs at no cost, for their use if they choose to do so. ANXO will be using the same tool to carry out its own IP performance measurements for random checking or trouble handling.

b) ANX CSP does not have to use the ANXO provided performance tool as long as they use an existing tool modified to comply with all the metric and measurement technique requirements. If ANX CSP chooses to use tools other than the ANXO provided tool, ANX CSP **shall** provide a detailed explanation of the test tools it uses, how the test tools comply with each individual requirement of the particular metrics they are used to measure, and to what values the test parameters are set to. ANXO may ask the ANX CSP additional information on the test tool specifics, if needed.

4. ANX CSP **shall** schedule these file transfer tests to include at least one busy hour measurement per day for each specific path, to cover worst case measurements. To the extent possible, timing of these tests per source-destination path **shall** be scheduled to not

overlap with the timing of tests over alternate source-destination paths, in order not to excessively overload its backbone to the disadvantage of its own network or any ANX Subscribed TP. Each individual test is designed to run at most a few minutes over the ANX network.

Measurement Technique:

R   The ANX CSP **shall** provide an updated diagram of its ANX network architecture, clearly describing the locations and IP addresses of the source and destination test points and the new ANX Subscribed TPs that are added in the last quarter. The connection rates of source test points, and customer access links, **shall** also be indicated. Whenever the number of new ANX Subscribed TPs results in an increase in the number of destination test points, the ANX CSP · **shall** perform this reporting process without waiting for the end of the quarter, and **shall** also provide an updated schedule describing the starting times of performance tests on each path, including the new paths, in compliance with the stated requirements. ANXO may request alternate locations for destination test points, and alternate test schedules for each source-destination path. The ANX CSP **shall** agree to carry out throughput, packet loss rate, file transfer delay, and packet latency performance tests (in compliance with the requirements set forth for these metrics) for the final set of paths and schedules that the ANXO approves.

[R4-3.: CertVer]   Access Link Utilization Metric

R   The ANX CSP **shall** measure access link utilization statistics for each ANX Subscribed TP it serves, except for dialup access customers. The ANX CSP **shall** also measure circuit utilization for all bilateral ANX CSP-ANX CSP connections it has.

R   Similarly, the ANX CEPO **shall** measure access link utilization statistics for each ANX CSP it serves.

Measurement Technique:

R   The ANX CSP/ANX CEPO **shall** monthly provide to the ANXO graphs of the access link utilization statistics and the average access link utilization measured over the last month on each ANX CSP-ANX CSP and ANX CSP-ANX CEPO access link. The ANX CSP **shall** also provide ANXO similar statistics on ANX Subscribed TP access links for the past 3 months, if specifically requested by the ANXO on a specific ANX Subscribed TP access link. The access link utilization MIB in the access equipment **shall** be sampled no less often than once per 15 minute time interval.

4.4.2 Fundamental Performance Metrics

For tripwire IP performance metrics such as throughput, packet loss rate, and file transfer delay, the ANXO **shall** perform similar tests to those carried out by the ANX CSPs, during the ANX Certification Verification period, using the black-box approach described earlier. The ANXO

will initiate these tests from the ANXO OC, ANXO-provided test points placed at an ANX Subscribed TP site or attached to the ANX CEP, for random spot-checking and troubleshooting upon complaint by an ANX Subscribed TP or an ANX CSP. The frequency of such tests, the number of ANX Subscribed TPs tested, and the proportion of the ANX CSP's network examined depends on the size and geographic extent of the ANX CSP's network, and upon the nature of the situation (i.e., suspected problem or routine monitoring).

[R4-4.: CertVer]   Throughput Metric

R   The throughput for an ANX Subscribed TP **shall** not be less than the quantity (access link bandwidth * C_Th/ F_LL) and **shall** meet the requirements set for this metric for ANX Certification Assessment. If fractional rate service is provided (e.g., fractional T1) then the bandwidth figure **shall** be adjusted proportionally. The quantitative Criterion for the throughput metric is C_Th = 0.50.

Measurement Technique:

R   The ANX CSP **shall** perform periodic throughput tests in compliance with all the requirements described for ANX Certification Assessment, collect a month's worth of data and report test results (i.e., average throughput over all file transfers) and raw test data (i.e., throughput of each file transfer) to the ANXO each month. The test for throughput **shall** consist of a series of large file transfers using TCP, to be carried out between a source and a destination test point, and distributed over the month, and **shall** be repeated for all the paths specified by the "network edge-to-edge testing metric"

[R4-5.: CertVer]   Packet Loss Rate Metric

R   The packet loss rate for the ANX Subscribed TP **shall** not exceed 0.1% (i.e., one packet in one thousand) and **shall** meet all the requirements set forth for this metric for ANX Certification Assessment.

Measurement Technique:

R   The ANX CSP **shall** perform periodic packet loss rate tests, collect a month's worth of data and report test results (i.e., average packet loss rate over all file transfers) and raw test data (i.e., packet loss rate of each file transfer) to the ANXO each month. The test for packet loss rate **shall** consist of a series of large file transfers using TCP distributed over the month, and **shall** be executed by the ANX CSP between a given source and a destination test point, for all the specified paths as specified by the "network edge-to-edge testing metric", and according to the ANX Certification Assessment requirements defined for this metric.

[R4-6.: CertVer]   Cell Loss Rate Metric

R   ANX CEPO **shall** have a cell loss rate of no greater than one cell in ten million under the entire range of operational load.

Measurement Technique:

R   The ANX CEPO **shall** collect per port and per PVC cell loss statistics on the ANX CEP switch, for each ANX CSP access port and each unidirectional PVC used for ANX Traffic between ANX CSPs. SNMP or other statistics collection means can be utilized. Measurements **shall** be based on sampling at 15 minute time intervals. The ANX CEPO **shall** monthly report to the ANXO, the average cell loss rate per access port and per PVC measured over the previous month.

[R4-7.: CertVer]   File Transfer Delay Metric

R   The delay metric Criterion C_D is compared to the most recent 30 file transfer delay measurements which are the same file transfers used to measure throughput and packet loss rate metrics. Of these, 90% of the measured delays **shall** be less than C_D as defined for ANX Certification Assessment. The delay values of tests with delays higher than C_D **shall** be noted as part of the test record. File Transfer Delay Metric measurements **shall** meet the requirements set for this metric for ANX Certification Assessment.

Measurement Technique:

R   The ANX CSP **shall** perform periodic file transfer delay tests, collect a month's worth of data and report test results (i.e., average file transfer delay over all file transfers) and raw test data (i.e., file transfer delay of each file transfer) to the ANXO every month. The test for delay consists of a series of file transfers using TCP distributed over the month, which are also used to measure throughput and packet loss rate and executed by the ANX CSP between a given source and a destination test point, for all the paths specified by the "network edge-to-edge testing metric. The set of at least 30 most recent file transfers (28 or 29 file transfers are allowed for 28- or 29-day months) **shall** be compared to the delay Criterion and the measurement methodology **shall** conform to the requirements described for ANX Certification Assessment.

[R4-8.: CertVer]   Network Edge-to-edge Packet Latency Metric

R   Network edge-to-edge packet latency is defined as the one-way delay of a packet to traverse an ANX CSP network. The latency for a small 64-Byte packet measured from edge-to-edge in an ANX CSP network (including the edge routers and the access links) **shall** not exceed 125 ms.

Measurement Technique:

R   For the ANX Network, edge-to-edge packet latency tests **shall** be carried out during a busy hour and **shall** be repeated every day and for all the paths specified by the network edge-to-edge testing metric. Approximating the one-way latency by half the average round trip delay **shall** be

allowed for ANX Release 1 for minimizing testing costs. ANX CSPs **shall** perform at least one hundred (100) 64-byte ping measurements at a busy hour every day, and **shall** repeat the same measurements for a month. Then the average round trip delay over all the measurements carried out within the month **shall** be halved to estimate one-way packet latency. The ANX CSP **shall** report the average round trip delay, and minimum and maximum values for each test, in addition to the average one-way packet latency over all the tests. More appropriate one-way latency measurements are allowed, if the ANX CSPs have the means to measure one-way delay directly.

4.4.3 Equipment Configuration/Utilization Metrics

[R4-9.: CertVer] Performance Data Tracking Metric

R Routers and switches have load and error tracking capability (e.g. packet counts over a defined time interval, packet drop counts, invalid CRC counts, etc.). The ANX CSP/ANX CEPO **shall** have the capability to track performance data for the nodes or network elements within its network.

Measurement Technique:

R The ANX CSP/ANX CEPO **shall** report its policies and procedures to the ANXO quarterly and **shall** report to the ANXO within 5 business days when the procedures used to record, monitor and trigger alarms (or other action) based on common network statistics changes. The ANX CSP/ANX CEPO **shall** provide the ANXO with a revised report meeting the requirement for ANX Certification Assessment for Performance Data Tracking within 30 days of such a change.

4.4.4 Dialup Modem Pool Metrics

[R4-10.: CertVer]   Dialup Blocked Call Ratio Metric

R If an ANX CSP provides dialup service, ANX CSP **shall** allocate adequate dialup port capacity so that the ratio of blocked to attempted calls **shall** not exceed 5% during any hour of the day. This includes the call blocking that can happen at a local carrier that provides dialup access for the ANX CSP.

Measurement Technique:

R The ANX CSP **shall** provide to the ANXO a monthly report of blocked call ratio statistics (# of blocks/ # of attempts), for a busy hour each day, for each hunt group directory number provided for accessing the ANX Network, for the previous month. The ANX CSP **shall** collect blocked call ratio statistics for the same busy hour used for the previous month for each directory number, unless statistics collection at another busy hour is requested by the ANXO.

1. In achieving and measuring this Criterion, the ANX CSP will need to cooperate with any local carrier(s) that it uses to provide dialup access. If dialup statistics are not available

from the local carrier(s), the ANX CSP **shall** actively collect blocked call ratio statistics (using internal or external resources) itself, for each hunt group directory number used for accessing the ANX Network, by dialing each number at least 6 times at a given busy hour, every day for the reporting period.

2.   If the ANX CSP fails this metric because of faults, inefficiencies in the LEC network, the ANX CSP **shall** provide proof of adequate dialup port capacity and LEC-based problems causing call blocking in order to avoid the probation state.

3.   The ANXO may request measurements to be performed at a different hour, upon which the ANX CSP **shall** comply with.

4.5 Summary of Performance Requirements

ANX Certification Requirements For Performance								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
4-	1	Yes	No	Test Termination Metric	Compliance	Yes	Quarterly or when changes occur	PDF
4-	2	Yes	No	Network Edge-to-edge Testing Metric	See Throughput; Packet Loss Ratio; File Transfer Delay; and Packet Latency	Yes	Quarterly or when changes occur	PDF
4-	3	Yes	Yes	Access Link Utilization Metric	Compliance	Yes	Monthly	PDF
4-	4	Yes	No	Throughput Metric	>50% of raw access link bandwidth, corrected for link layer technology	Yes	Monthly	text
4-	5	Yes	No	Packet Loss Metric	≤ 1/1 000	Yes	Monthly	text
4-	6	No	Yes	Cell Loss Metric	≤1/10 000 000	Yes	Monthly	PDF
4-	7	Yes	No	File Transfer Delay Metric	≤ NT or sum of access serialization, propagation and network element processing	Yes	Monthly	text
4-	8	Yes	No	Network Edge-to-edge Packet Latency	≤ 125msec	Yes	Monthly	text
4-	9	Yes	Yes	Performance Data Tracking Metric	Compliance	Yes	Quarterly or when changes occur	PDF
4-	10	Yes	No	Dialup Blocked Call Ratio Metric	≤ 5%	Yes	Monthly	PDF

Table 4-5: Performance Requirements Summary

5. Reliability Metrics

5.1 Scope

Reliability is defined as the science aimed at predicting, analyzing, preventing and mitigating failures over time. Broadly, reliability includes availability, customer perceived downtime, risk and outages.

This section provides reliability metrics, requirements for those metrics, and a procedure for collecting those metrics. Metrics that define routing stability and methods for maintaining route stability are discussed in Section 3, thus no requirements are specified in this section regarding routing stability.

5.2 Approach & Methodology

5.2.1 Approach

The reliability requirements defined here are developed for the three major parts of ANX Release 1 architecture. The three parts are:

1. the ANX Subscribed TP Access Network, consisting of the egress router at the ANX Subscribed TP site and the access line connecting to but not including the ingress router in the ANX CSP network (Alternate access methods such as dialup are not discussed in this version).

2. the ANX CSP network spanning from the ingress router(s) connecting to the ANX Subscribed TP Access Network to the egress router(s) which are the ANX CSP's border router(s) that connect to an ANX CEPO or another ANX CSP network.

3. the ANX CEPs that will interconnect all or a subset of the ANX CSPs in the ANX Network.

These parts are, for the purposes of setting reliability requirements, treated as "black boxes" with only overall end-to-end requirements specified. Exceptions to this rule are sometimes necessary and the reasons for the exceptions are noted.

Figure 5-1 below shows the reference connection model based on the ANX Release 1 architecture which is used to allocate the end-to-end availability Criteria to the ANX Subscribed TP Access Network, ANX CSP network, and ANX CEP.
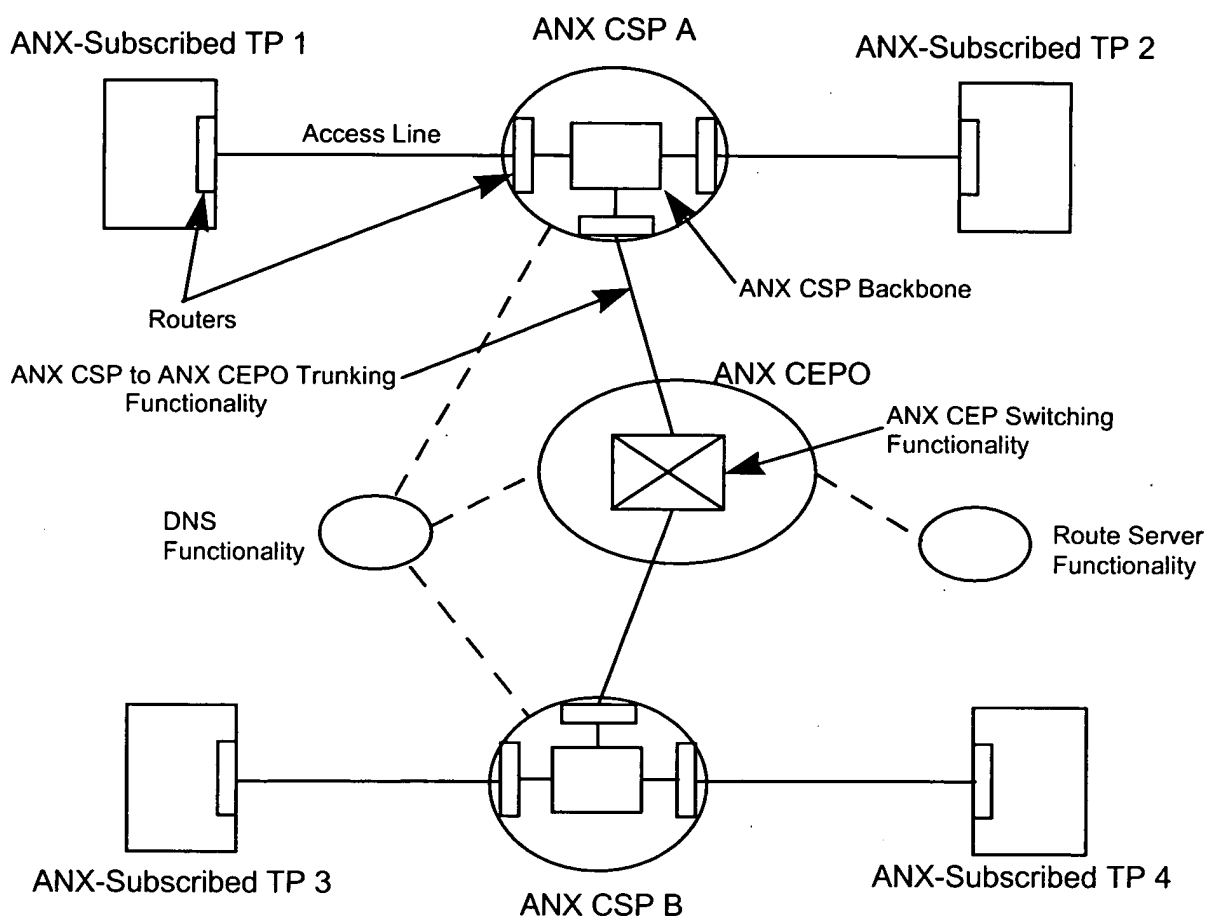
Figure 5-1: Reference Model

Exceptions to the reference architecture are sometimes necessary in actual deployments. When exceptions occur, the unavailability requirements may be allocated among the ANX CSP and ANX CEPO based on the actual deployed architecture, with the common agreement of all the parties involved and the ANXO. Exceptions are discussed in Section 5.2.3.

Figure 5-2 shows how the requirements in this section correspond to portions of the reference architecture.
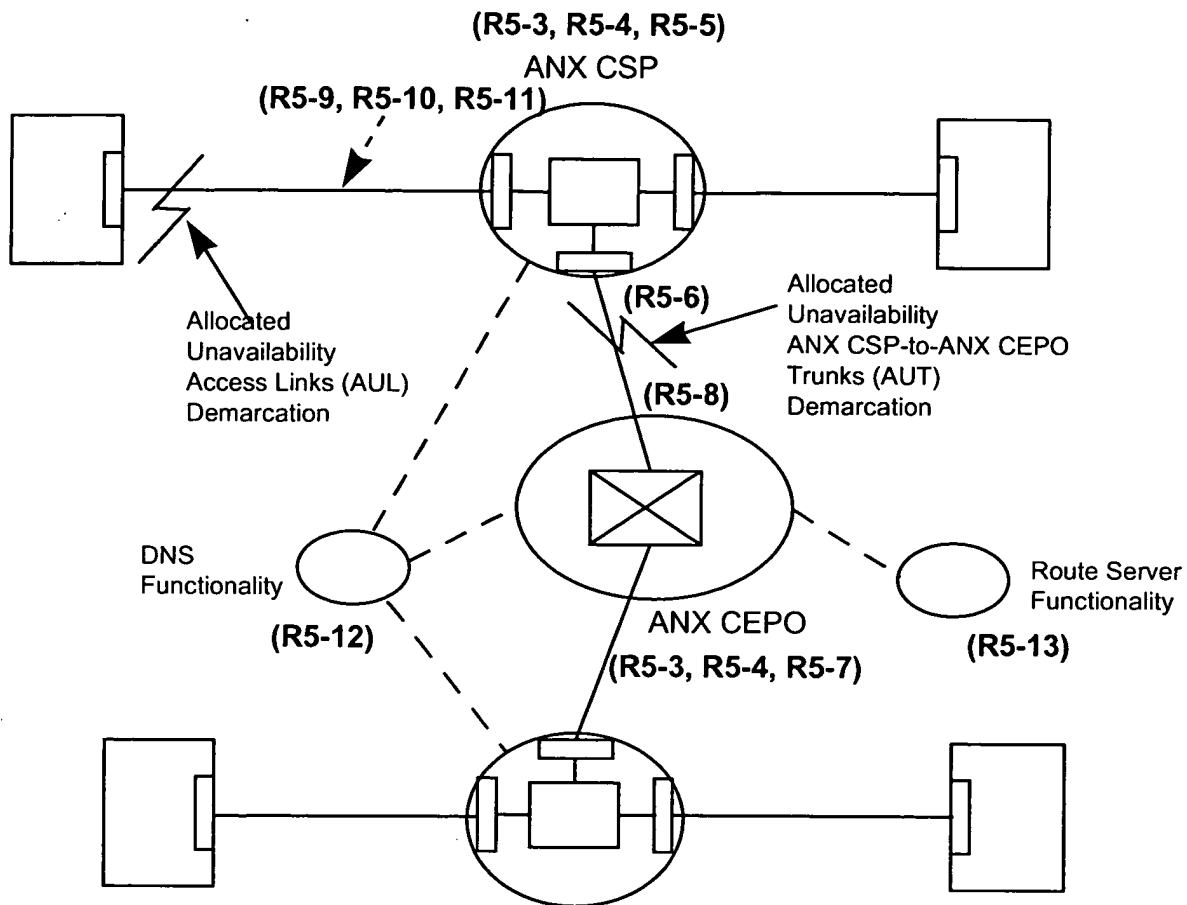
Figure 5-2: Metrics Requirements Applied to the Reference Architecture

5.2.2 Industry Analysis

While equipment/circuit failures are common causes for unavailability, interdomain routing instabilities in the public Internet, such as prevalence of routing loops, route flaps, and erroneous routing, are other causes for infrastructure failures and temporary outages. Interdomain routing stability at large has thus a direct impact on network reliability.

Due to its decentralized, uncontrolled structure, the public Internet is not sufficiently reliable for the ANX. The ANX network needs to meet ANX reliability requirements to allow the automotive industry to use it as a business network.

5.2.2.1 Definition of Availability (and Unavailability)

Availability is defined as the proportion of time that the network or a portion of the network is available or "up" for service. To be available means that the network or portion of the network, whichever is being described, is in a state ready to perform a required function or functions at a given instant in time or for any period within a given time interval. Availability should be high, so that the network or network part is perceived by users as being "up" almost all of the time.

Availability is usually measured in terms of percentage of available time in a defined interval or minutes of uptime in the interval. The interval is typically a month, quarter or a year.

Unavailability is the complement of availability, that is, it is the percentage of downtime in the same interval. If A equals the availability in percent, then $U = 100 - A$ is the unavailability in percent. Unavailability is approximately additive for a system of elements in which the failure of any element causes the system to become unavailable and the probability of a element failure is a statistically independent event. Thus, in the ANX the unavailability of the end-to-end connection between two ANX Subscribed TPs can usually be estimated by summing up the unavailability of the Access Networks, ANX CSP network(s), and ANX CEP in the path. The end-to-end unavailability is that which is experienced by the ANX Subscribed TPs.

Because there are 8760 hours in a year, each 0.1% unavailability for a network component represents 8.76 hours of downtime for that component. If a component type appears more than once in the end-to-end path between two ANX Subscribed TPs, then that component type may have a greater impact on end-to-end service unavailability as experienced by the ANX Subscribed TPs.

5.2.2.2 Determining Availability Requirements

The availability requirements for the ANX network elements should be determined using a design process which is based on a combination of: (1) an end-to-end network service objective(s) for the service(s) which use the network, (2) a reference ANX network architecture, (3) an allocation of the service objective to the relevant parts of the network, and (4) performance data derived through experience with the operation of similar networks and services. This information is used in a design process called "top-down" design to allocate the end-to-end service objective(s) to the relevant ANX network parts, i.e., the ANX Subscribed TP Access Network, the ANX CSP network, and the ANX CEP, and set requirements for those parts that both meet the customers' service objectives and are achievable by the technology available. Defining requirements which both meet customers' service objectives and are achievable using existing network technology, is not always possible. In such cases it may be necessary to compromise on the service objectives, reducing them to fit into the achievable realm of existing network technology. Or, in some cases, it may be possible to design the network with several

different grades of Service Quality available to customers at different prices. Customers not satisfied with the "standard" grade could opt to purchase a higher grade of service at a price.

5.2.2.3 Available Performance Data

This section is based on (1) available data for the availability of the network parts from industry, (2) operational data [Part 6, Ref# 14], and (3) base-line service-level objectives on the availability of local switched public telephone networks [Part 6, Ref# 15]. The base-line objectives have been developed for telephone network engineering purposes. These objectives are primarily used during network architecture studies, product concept studies, and reliability evaluations. In addition, they are also used as base-line performance objectives for comparison to actual field performance. Using this information a top-down design process has been used to set requirements in subsequent sections for the ANX CSP, ANX CEPO and the Access Network.

5.2.3 Exceptions to the Reference Architecture

Exceptions to the reference architecture are sometimes necessary in actual deployments. When exceptions occur, the unavailability requirements may be allocated among the ANX CSP and ANX CEPO based on the actual deployed architecture, with the common agreement of all the parties involved and the ANXO.

The exact manner in which this allocation is done will depend on the circumstances of the actual deployment. However, it is anticipated that almost all partial allocations will occur either in provisioning Access Networks or in provisioning the ANX CSP-to-ANX CEPO access trunks. Also, it is anticipated that the unavailability allocation for network elements and facilities will be apportioned among the parties involved as a percentage in proportion to their responsibility for acquiring and/or maintaining those elements or facilities.

To reflect exceptions to the reference architecture, some availability requirements (used for cases that differ from the reference architecture) include two allocation factors:

- The factor AUL represents "Allocated Unavailability - Access Link" as a percentage of the access link unavailability allocated to the ANX CSP. Unless other arrangements are reported to the ANXO, the ANXO will assume AUL = 100%.

- The factor AUT represents "Allocated Unavailability - ANX CSP-to-ANX CEPO trunk" as a percentage of the trunk unavailability allocated to the ANX CEPO. Unless other arrangements are reported to the ANXO, the ANXO will assume AUT = 50%. This implies that 50% of trunk unavailability will be allocated to the ANX CSP.

Sections 5.2.3.1 and 5.2.3.2 provide examples to illustrate some of the principles of the allocation process.

5.2.3.1 Example of Split Responsibility for the ANX CSP-to-ANX CEP Trunk Availability

When exceptions to the reference architecture occur with respect to the ANX CSP-to-ANX CEPO trunk, the unavailability requirements may be allocated between the ANX CSP and ANX CEPO based on the actual deployed architecture, with the common agreement of all the parties involved and the ANXO. It is anticipated that the unavailability allocation for network elements and facilities will be apportioned between the parties involved in proportion to their responsibility for acquiring and/or maintaining those elements or facilities. This section provides an example to illustrate some of the principles of the allocation process.

In this example, the ANX CSP and the ANX CEPO split the responsibility for the ANX CSP-to-ANX CEP trunk availability. The unavailability requirements in Sections 5.3.2.2 and 5.3.3.2 assume that the trunking functionality connecting an ANX CSP and the ANX CEPO will have at least 99.99% availability, on average. This can be achieved by provisioning mutually diverse primary and back-up trunks engineered with a separate availability of 99.5% each, which would provide an expected 99.9975%. With 99.99% availability, there will be connectivity between the ANX CSP and ANX CEPO for all but 52.5 minutes per year, on average.

By mutual agreement, the ANX CSP and ANX CEPO have decided to share responsibility for the trunking functionality. The ANX CSP and ANX CEPO establish a demarcation point somewhere in mid-span in one trunk's transmission facility (perhaps at a repeater station). If the trunking functionality is provided on more than one trunk, there may be one demarcation point one each trunk. Each party agrees to be responsible for the access trunk facilities on its side of this demarcation point. Furthermore, because of how the demarcation point(s) is (are) chosen, the parties, with the ANXO's approval, have agreed that the ANX CEPO portion of the trunking functionality will be allocated AUT = 60% of the allowable end-to-end unavailability of 0.01%. The ANX CEPO-portion unavailability is calculated as AUT x 0.01% = 0.006%. Similarly, the ANX CSP portion is allocated (100 - AUT) = 40% of the allowable unavailability, or 0.004%. Note that the two allocations sum to 0.01%.

Having made such an allocation, the ANX CEPO and the ANX CSP will now be responsible for monitoring the unavailability of their portions of the access trunk and for separately reporting outages on their portions of the access trunk(s) and separately reporting unavailability measurements for service affecting outages to the ANXO. They will each assume responsibility for the compliance of their portions of the access trunk. In this example, the ANX CSP will be responsible for its access trunk portion, with an allocated downtime for service-affecting outages of (0.006% x 8760) = 0.53 hour per year, equivalent to 31.5 minutes per year. The ANX CEPO will be responsible for its portion of the access trunk, with an allocated downtime for service-affecting outages of (0.004% x 8760) = 0.35 hour per year, equivalent to 21.0 minutes per year.

The ANX CSP will have full responsibility for service affecting outage if the outage event(s) occur entirely in the portions of the trunk(s) for which it is responsible; the ANX CEPO will have full responsibility for service affecting outage if the outage event(s) occur entirely in the portions of the trunk(s) for which it is responsible. If a service affecting outage is caused by a combination of events that occur on portions of the trunk(s) that are the responsibility of the ANX CEPO and also on portions of the trunk(s) that are the responsibility of the ANX CSP, then the ANX CEPO will be responsible for AUT% of the outage duration and the ANX CSP will be responsible for $(100 - AUT)\%$ of the outage duration. Availability measurements will be adjusted so that availability is reported as availability of the portion of the trunking functionality that is the responsibility of the ANX or ANX CEPO. This adjustment is made by dividing the measured unavailability that is the responsibility of the ANX CEPO by AUT%, for the ANX CEPO; and dividing the measured unavailability that is the responsibility of the ANX CSP by $(100 - AUT)\%$, for the ANX CSP. This adjustment is done for ease of comparison with the criterion of 99.99% overall availability.

For cases where a single extended outage occurs, the probationary provisions described in Section 5.4.1.4 may apply.

Note that the ANX CEPO will probably have access trunk connections to multiple ANX CSPs, and it is therefore possible that the ANX CEPO and these many ANX CSPs could enter into unique agreements concerning the allocation of the access trunk availability requirement. It is also possible that different agreements will be made for the primary and the backup access trunks.

5.2.3.2 Example of Split Responsibility for the ANX TP-to-ANX CSP Access Network Availability

When exceptions to the reference architecture occur with respect to the ANX Subscribed TP-to-ANX CSP access network, the unavailability requirements may be allocated to the ANX CSP based on the actual deployed architecture, with the common agreement of all the parties involved and the ANXO. It is anticipated that the unavailability allocation will be proportional to the ANX CSP's responsibility for acquiring and/or maintaining the access network. This section provides an example to illustrate some of the principles of the allocation process.

In this example, an ANX Subscribed TP and an ANX CSP split the responsibility for the ANX Subscribed TP-to-ANX CSP Access Network. The unavailability objectives assume that one-half of the unavailability in the access network is attributable to failures of the ANX Subscribed TP-site router and the remaining one-half of the unavailability is attributable to the facilities connecting the ANX Subscribed TP site to the ANX CSP ingress router. The required average availability for the Access Network is to be 99.5% (all but 43.8 hours per year), the average availability objective for the Access Network is 99.8% (all but 17.5 hours per year), and the

availability objective for each specific Access Network is to be 99.5% (all but 43.8 hours per year).

By mutual agreement and with the agreement of the ANXO, the ANX Subscribed TP and the ANX CSP have decided that the ANX Subscribed TP-site router will be acquired and maintained by the ANX Subscribed TP. Furthermore, the parties have agreed that router outages account of one-half of the Access Network downtime. In this case, AUL = 50%. The ANX CSP's average availability requirement is adjusted to reflect the (43.8 x 50%) = 21.9 hours per year allowable unavailability that is the ANX CSP's responsibility. The ANX CSP's average availability objective is adjusted to reflect the (17.5 x 50%) = 8.75 hours per year allowable unavailability that is the ANX CSP's responsibility. The ANX CSP's unavailability objective (for the specific ANX Subscribed TP involved in this agreed allocation) is (43.8 x 50%) = 21.9 hours per year. The ANX Subscribed TP assumes responsibility for any other Access Network unavailability.

Availability measurements will be adjusted so that availability is reported as availability of the portion of the trunking functionality that is the responsibility of the ANX CSP, for ease of comparison with.

Availability measurements will be adjusted so that availability is reported as availability of the portion of the Access Network that is the responsibility of the ANX CSP. This adjustment is made by dividing the measured unavailability that is the responsibility of the ANX CSP by AUL%. This adjustment is done for ease of comparison with the criteria for average availability requirement, average availability objective, and availability objective for the individual Access Network.

Note that the ANX CSP may enter into unique agreements concerning the allocation of the access network availability requirement with many of its individual ANX Subscribed TPs.

5.2.4 Methodology

The methodology for determining the availability of the ANX CSP network, Access Network, and ANX CEP is based on monitoring outage events and customer complaints that may indicate that an unavailability condition exists and analyzing these events to determine whether or not an unavailability condition exists (i.e., it is service affecting). If an unavailability condition is found to exist then the extent of the impact on customers is determined. The duration of the unavailability event is weighted by an impact function which is based on analysis of the amount of impact on customers. Then the weighted values of all the unavailability events that occurred in the quarter are summed to determine the quarterly average unavailability measurement. This quarterly measurement is annualized so it can be compared to the requirement and is reported to the ANXO.

The ANX CSP is responsible for determining when an unavailability condition occurs in the ANX CSP network and for analyzing the condition to calculate the impact of the event on customers. Each quarter the ANX CSP must report the unavailability of the ANX CSP network and of all Access Networks it is responsible for to the ANXO. Whether or not an ANX CSP is responsible for the availability of an Access Network depends on whether the Access Network was offered to the ANX Subscribed TP as one part of the total service package. If so, the ANX CSP is responsible for the availability of the Access Network. If the ANX Subscribed TP obtained the Access Network from a third party (e.g., the local exchange carrier) then the ANX CSP is not responsible for and does not have to report the availability of the Access Network to the ANX.

The ANX CEPO is responsible for the availability of the EP and must report quarterly to the ANXO its measurement of the unavailability of the EP switches/routers.

The methodology for Reliability measurements is:

1. The ANX CSP/ANX CEPO provides periodically network design and layout evidence to the ANXO.

2. The ANXO analyzes the adequacy of the evidence.

3. The ANX CSP/ANX CEPO provides periodic measurements data to the ANXO.

4. The ANXO analyzes the periodic data.

5. The ANXO may periodically or randomly audit the ANX CSP/ANX CEPO.

5.2.5 End-to-End Unavailability as Seen by ANX Subscribed TPs

This section discusses the implications of the ANX reliability objectives on the end-to-end connectivity between two ANX Subscribed TPs. If we assume that ANX Subscribed TP 1 and ANX Subscribed TP 4 (as in Figure 5-1) are served by ANX CSP A and ANX CSP B, then a complete end-to-end connection requires the network components shown in Table 5-1 to all be working.

The first column of Table 5-1 indicates the network component. The second column indicates the average reliability requirements as a percent, keyed to the requirements in the "ANX Certification Requirements For Reliability." The third column indicates the equivalent unavailability as a percent. The fourth column indicates the equivalent unavailability as hours per year. The fifth column shows how unavailability accumulates across ANX network components.

The last row of Table 5-1 shows that the end-to-end unavailability between any two ANX Subscribed TPs (served by different ANX CSPs) is expected to be approximately 43 hours per year. (For illustration purposes, this assumes that the TP Access Network availability is equal to

the average Access Network availability objective, that the ANX CSP-to-ANX CEPO trunking availability is equal to the average trunking availability, and that the annual average availability in all other categories just meets the availability requirement.) Adding "Access Network Availability" + "Overall Network Availability" in column five, we see that each ANX Subscribed TP (on average) will be isolated from all ANX Connections an estimated total of $(17.52 + 2.63) = 20.15$ hours per year.

Table 5-1: End-to-End Availability Estimate

Network Component	Availability Requirement (or Objective)*	Equivalent Unavailability	Hours per Year Unavailability	Cumulative Hours per Year Unavailability
Access Network Availability (ANX Subscribed TP 1 to ANX CSP A, average case, objective)	99.8% (Objective)*	0.02%	17.52	17.52
Overall Network Availability (ANX CSP A)	99.97%	0.03%	2.63	20.15
ANX CSP-to-ANX CEPO Trunk Availability (ANX CSP A to ANX CEPO)	99.99%	0.01%	0.88	21.03
ANX CEPO Overall Service Availability	99.995%	0.005%	0.44	21.47
ANX Route Server Overall Availability	99.999%	0.001%	0.09	21.56
ANX CSP-to-ANX CEPO Trunk Availability (ANX CSP B to ANX CEPO)	99.99%	0.01%	0.88	22.44
Overall Network Availability (ANX CSP B)	99.97%	0.03%	2.63	25.07
Access Network Availability, (ANX Subscribed TP 4 to ANX CSP B, average case, objective)	99.8% (Objective)*	0.02%	17.52	42.59
End-to-End (Approximate)	99.5% (Objective)*	0.05%	42.59	

* Table 5-1 shows the average availability objective for the Access Network. The average availability requirement for the Access Network is 99.5%. Replacing the objective (99.8%) with the requirement (99.5%) in the calculations would give an estimated end-to-end availability of 98.9% (equivalent to 96.4 hours per year end-to-end unavailability).

5.3 ANX Certification Assessment Requirements

5.3.1 Reliability Metrics Calculation and Reporting Requirements for ANX CSPs and ANX CEPOs

This section specifies outage and reliability reporting requirements common to ANX CSPs and ANX CEPOs.

5.3.1.1 Outage Events

An outage event of a network or network element is defined as an event lasting at least 10 seconds which makes the network or network element partially or totally unavailable. If the

event does not last at least 10 seconds then no unavailability has occurred, for our purposes. An outage event is one of the indicators that is used to determine when unavailability may exist. Other indicators are also used to determine when an unavailability problem may exist. For example, a customer complaint which leads to generation of a trouble ticket can be used to indicate a possible unavailability condition. However, by themselves customer complaints are not reliable indicators, because customers do not always complain. Also in an event which affects many customers only a few may actually complain. (For instance, when you have a power outage at home do you always call the power company or do you sometime assume that someone else will or already has?) Note that the presence of one or more of these indicators does not automatically mean an unavailability condition exists, only that one may exist. Further analysis is required to determine that an unavailability condition exists and, if so, the extent of its impact on customers.

5.3.1.2 Outage Event Types

Outage events have several different characteristics and it is important to define and consider these differences because they affect whether or not the events are counted in the calculation of the unavailability. Three distinct outage event classifications are discussed below, with requirements concerning if, when, and how they are to be counted. The three classifications, which are not independent, are:

1. Hard vs. soft

2. Service affecting vs. Non-Service Affecting

3. Scheduled vs. Unscheduled

5.3.1.2.1 Hard vs. Soft Outage Events

A hard outage event is one that can cause "hard" unavailability. Hard unavailability occurs when the service is totally unavailable (i.e., the "system" is "dead" and offers no response to customer inputs). Soft outage events can cause "soft" unavailability, which occurs when the service is available but the performance (e. g., latency, packet loss rate) falls below tolerable thresholds. In ANX Release 1 only the hard outage events are considered.

5.3.1.2.2 Service-Affecting vs. Non Service-Affecting Outage Events

An outage event may be service affecting or it may not be service affecting. The ANX CSP outage event data collection system will collect information about all outages whether or not they are service affecting.

A service affecting outage event is one in which the service of at least one customer is unavailable. A non-service affecting outage event is an event which does not cause unavailability.

5.3.1.2.2.1 CSP Portion of the Reference Architecture

For ANX CSPs, only service affecting outage events along with other indicators such as customer complaints will be used to calculate the overall availability in the ANX CSP network. Non-service affecting outages will be reported but will not be used in calculating overall availability.

The ANX CSP must take care to properly record outage events that involve redundant components. An outage involving one redundant component is (in general) not service affecting, as long as a second redundant component is available and is able to handle all of the offered traffic. However, if a second component is not available or if a second component is unable to handle all of the offered traffic, then a service-affecting outage must be recorded.

Also, the ANX CSP must take care to properly record outage events that affect ANX CSP-to-ANX CEPO access trunks, if the ANX CSP is responsible for a portion of the ANX CSP-to-ANX CEPO trunking, as explained in Section 5.3.2.2.

5.3.1.2.2.2 CEPO Portion of the Reference Architecture

The ANX CEPO must compute outage statistics for all outages that affect a primary or back-up ANX CEP service (ATM switch or a network of interconnected ATM switches), whether or not they are service affecting, and all outages that affect a primary or back-up ANX CSP-to-ANX CEPO trunk, whether or not they are service affecting.

In addition, the ANX CEPO must take care to properly record service-affecting outage events that involve redundant components. Events that cause ANX CEP service to be unavailable to one or more ANX CSPs must be separately recorded and reported as service affecting. Such events may include (but are not limited to) events where:

- both the primary and back-up ANX CEP service (ATM switch or a network of interconnected ATM switches) are unavailable (or all ANX CEP service is unavailable, if more than two service sites are provided)

- both the primary or back-up ANX CSP-to-ANX CEPO trunks for any ANX CSP (or all ANX CSP-to-ANX CEPO connectivity is lost, if more than two trunks are provided)

- the primary ANX CEP service point is unavailable and the ANX CSP-to-ANX CEPO trunk(s) connecting any ANX CSP to its back-up ANX CEP service point is (are) unavailable; or the ANX CSP-to-ANX CEPO trunk(s) connecting any ANX CSP to its

primary ANX CEP service point is (are) unavailable and the back-up ANX CEP service point is unavailable.

If an ANX CSP shares responsibility for a portion of the ANX CSP-to-ANX CEPO trunks, then the ANX CSP must compute outage statistics for all outages that affect that portion of the primary or back-up ANX CSP-to-ANX CEPO trunk(s) it is responsible for, whether or not they are service affecting.

In addition, the ANX CSP must take care to properly record service-affecting outage events that involve redundant ANX CSP-to-ANX CEPO trunks. Events that cause ANX CEP service to be unavailable to the ANX CSP because of ANX CSP-to-ANX CEPO trunking that the ANX CSP is responsible for must be separately recorded and reported as service affecting.

5.3.1.2.3 Scheduled vs. Unscheduled Outage Events

Outage events can be scheduled or unscheduled (unexpected). Scheduled events are planned and can occur whenever hardware/software upgrades are installed or NEs are exercised. Unscheduled events are not planned and usually caused by some unexpected reliability problem.

Scheduled outage event durations that are service affecting are counted in the calculation of overall availability. The only exception is that scheduled events are not be counted if through prior agreement (e.g., part of the customer service agreement) the affected users agree to allow the scheduled outage during a pre-agreed time period (e.g., 1 am to 5 am). If a scheduled event continues past the pre-agreed time period, then the portion of the event which is outside the pre-agreed limit is counted. If a scheduled event affects the service of some customers whom have not agreed to permit scheduled events during a pre-agreed period then only those users will be counted in the calculation of the availability for that event.

It is assumed that there will be no scheduled outages for ANX CEPO services. Because of the large anticipated number of TPs across North America, it is unlikely that a common time for a planned outage will be acceptable to all TPs. (Notice that this does not mean that there may not be planned outages for individual ANX CEPO servers. For example, a primary ANX CEPO switch may be brought down for planned maintenance or a planned upgrade, but ANX CEPO switching functionality should continue to be provided by a back-up ANX CEPO switch.)

5.3.1.3 Outage Event Data Collection

The ANX CSP and ANX CEPO are expected to have a means for detecting possible unavailability conditions (by SNMP, other monitoring for outage events, and collecting customer complaints) and collecting and reporting this information to the ANX CSP NOC for analysis. Typically the network elements automatically detect outages and record them on trouble logs, alarms, tickets, etc..

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The ANX CSP and ANX CEPO outage event data collection system will collect *at least* the following information about outage events:

1. Date and time of occurrence.

2. Element affected.

3. Location of element.

4. Duration of outage event.

5. Service-affecting or non service-affecting event.

6. If a service affecting event, record the value of the impact metric. For an ANX CSP the impact metric is defined to be the number of ANX Subscribed TP interfaces affected divided by the total number of ANX Subscribed TP interfaces of an ANX CSP. For an ANX CEPO the impact metric is defined to be the number of ANX Subscribed TP interfaces affected divided by the total number of ANX Subscribed TP interfaces.

This information will be gathered and saved by the ANX CSP and ANX CEPO to be used for the quarterly measurement of overall availability.

R ANX CSP and ANX CEPO data collection and metric calculation **shall** comply with the following:

1. The ANX CSP **shall** collect and report information about all outage events, whether or not they are service affecting. The collected information **shall** *at least* include:

   a) Date and time of occurrence;

   b) Element affected;

   c) Location of element;

   d) Duration of outage;

   e) Service-affecting or non service-affecting; and

   f) Value of the impact metric (number of ANX Subscribed TP interfaces affected / total number of ANX Subscribed TP interfaces of an ANX CSP) for service affecting events.

2. In calculation of the overall availability of its network, ANX CSP and ANX CEPO **shall** only use service affecting outage events, including service affecting scheduled outages, with the only exception of customer- agreed scheduled outages that confine to a pre-agreed time period, as explained in Section 5.3.1.2.

3. If a pre-agreed scheduled event continues past the pre-agreed time period, then ANX CSP and CEPO **shall** include in the calculations, the portion of the event which is outside the pre-agreed limit.

4. If a scheduled event affects the service of some customers whom have not agreed to permit scheduled events during a pre-agreed period, then ANX CSP and ANX CEPO **shall** include outage durations for only those users in the calculation of the availability for that event.

5. ANX CSP and ANX CEPO **shall** each quarter, calculate and report to the ANXO on a control chart, the quarterly measurement of overall unavailability as described in Section 5.3.1.4.

R The ANX CSP or ANX CEPO **shall** prepare and provide materials for an audit of the metric, and **shall** participate in an audit, as required by the ANXO. The ANXO will audit ANX CSP and ANX CEPO processes for outage data collection and outage reporting, ANX CSP and ANX CEPO reliability calculations, ANX CSP and ANX CEPO outage logs, and related materials used by the ANX CSP and ANX CEPO to prepare required reliability reports. Audits may include a site visit to ANX CSP or ANX CEPO premises. Audits may include an independent calculation of metrics by the ANXO. Audits may also include audits of reliability models, if the ANX CSP or ANX CEPO uses reliability models to support ANX Certification Assessment.

If the amount of outage event data for the ANX CSP is insufficient to make these measurements for ANX Certification Assessment purposes, then an alternative is to use reliability prediction models to predict the overall availability.

5.3.1.4 Calculation of Availability

R For metrics requiring the calculation of availability, the ANX CSP and ANX CEPO **shall** calculate availability, and report calculated results to the ANXO each quarter using the following procedure, or an equivalent procedure:

1. For each service affecting outage event, compute the impact of the outage on ANX Subscribed TPs. To compute the impact of the outage, multiply the duration in minutes by the impact metric value (a number between 0 and 1), as described in Section 5.3.1.3. The impact metric value is calculated as the number of ANX Subscribed TP access points affected divided by the total number of ANX Subscribed TP access points served by an ANX CSP.

2. Multiply by 4 (quarters) to annualize the measurement.

3. To compute the total unavailability in hours, sum up for all the outage events in the quarter and divide the result by 60 to obtain the estimate of the annual unavailability.

4. For ANX CSPs, to compute the annualized unavailability as a percent, divide the total unavailability in hours, from step 3, by the average number of contracted hours of service for all ANX Subscribed TPs served by an ANX CSP, and multiply by 100 to give a percent. (For example, an ANX Subscribed TP with a contracted maintenance window of two hours per week would have (7 x 24 - 2) x 52 = 8632 contracted hours of service per year.) For ANX CEPO, to compute the annualized unavailability as a percent, divide

the total unavailability in hours, from step 3, by 8760, and multiply by 100 to give a percent. The annualized availability is 100 minus the unavailability as a percent.

5.   Report the annualized availability as a percent, the annualized unavailability as a percent, the annualized unavailability in hours, and the annual unavailability requirement as a percent to the ANXO on a quarterly basis in a table.

6.   Compute a moving average of overall average results by summing results from the most recent four quarters of data and dividing by 4 (or by summing results from all quarters if fewer than four quarters of data are available, and dividing by the number of quarters). Report overall average in a table.

For example, if a candidate ANX CSP submits data for 6 months (2 quarters) such that the measurements of availability for each quarter are as shown in the following table, then the ANX CSP would be certified as having met the availability requirement, because the overall average of 2.3 hours/year meets the requirement.

Quarter	Availability (%)	Unavailability (%)	Availability (hrs/year)	Unavailability Requirement (%hrs/year)
1Q	99.986	0.014	1.2	99.97
2Q	99.961	0.039	3.4	99.97
Overall Average	99.974	0.026	2.3	99.97

5.3.1.5 Network Availability Modeling

If the amount of outage event data for the ANX CSP or ANX CEPO is insufficient to make these measurements for ANX Certification Assessment purposes, then an alternative is to use reliability prediction models to predict the overall availability. An acceptable model will include at least the following features:

1.   identification of network components; components include network nodes (such as routers) and network links (such as Access Networks and trunking facilities)

2.   identification of network architecture; the network architecture describes the interconnections among network components

3.   estimated traffic routing and volume between ANX Subscribed TPs

4.   identification of failure modes for components (e.g., hardware failures, software failures, procedural errors, environmental disasters, etc.)

5.   predicted mean-time-to-failure (MTTF) and predicted mean-time-to-repair (MTTR) for each type of network component

6.   identification of component failures and/or combinations of component failures that will cause a service outage, considering the network architecture

7.   predicted frequency, duration, and impact of service outages, considering component failure estimates, the network architecture and estimated traffic routing and traffic volume

8.   calculation of the predicted value of all ANX-required metrics (e.g., predicted overall availability, predicted average service restoration time, predicted number of total network outages, predicted Access Network availability, etc.).

Component MTTF and MTTR may be estimated in at least two ways:

1.   Component MTTF and MTTR may be estimated from historical data from other networks using the same types of components.

2.   Component MTTF and MTTR may be estimated by Markov reliability models. These models are used to estimate availability and downtime of individual network elements. Each major type of element needs to be modeled. The failure rate of each component of the system is needed as input to these models. These failure rates can be obtained by applying a reliability prediction procedure. Detailed predictions for each component is very labor intensive and may not be needed. However, a good description of the redundancy in each network element is absolutely essential. Tools for modeling and predicting reliability are readily available from many sources [Part 6, Ref# 12-13].

5.3.1.6 Metrics Calculation for ANX Certification Assessment

R   For purposes of ANX Certification Assessment, the calculations **shall** be based on either: (1) measured outage data collected from the ANX CSP operation for 3 months, (2) predictions obtained from reliability models of the ANX CSP network, or (3) a combination of both.

[R5-1.: CertAss]   Reliability Data Calculation/Reporting Requirements

R   ANX CSPs/ANX CEPOs **shall** follow the procedures described in Section 5.3.1, and **shall** comply with all the requirements stated in Sections 5.3.1.3 through 5.3.1.6 for calculating and reporting the reliability metrics that concern availability/unavailability of ANX Network entities defined by the Reference Architecture in Figure 5-1 and Figure 5-2.

Measurement Technique:

R   ANX CSP/ANX CEPO Applicants **shall** comply with all the procedures and requirements described in Section 5.3.1 in calculating and reporting the availability metrics stated in Figure 5-2.

5.3.1.7 Outage Notification Requirement

[R5-2.: CertAss]   Inter-ANX CSP and ANX CEPO Outage Notification

R   The ANX CSP and ANX CEPO **shall** participate in an electronic bulletin-board style inter-ANX CSP and ANX CEPO Notification program that will be hosted by the ANXO to facilitate the troubleshooting of the ANX Network problems, and outage events that affect the ANX Subscribed TPs. The outage event information provided by the ANX CSP or ANX CEPO will be · accessible only by the ANXO, ANX CSPs, ANX CEPOs and ANX Subscribed TPs. The ANX CSP and ANX CEPO **shall** notify the other participating ANX CSPs and ANX CEPOs of significant scheduled and unscheduled outage events within its network. The ANX CSP or ANX CEPO reporting an outage **shall** submit the report to the ANXO as an IPSec-encrypted ASCII text e-mail message, and **shall** follow the instructions provided by the ANXO for posting an outage to the bulletin board.

Measurement Technique:

R   A significant outage event is defined as an outage event that lasts at least 30 minutes and that affects more than one trading partner, or any outage event that lasts at least 24 hours. ANX CSP and ANX CEPO Applicants **shall** commit to notify outages using ANXO-hosted electronic bulletin-board program at least 5 business days prior to significant scheduled outages, and within 48 hours of the occurrence of significant unscheduled outages as an incident report. ANX CSP and ANX CEPO Applicants **shall** test the outage reporting process by submitting a "test" message to the bulletin board prior to ANX Certification Assessment. The outage information reported on the ANXO-hosted electronic bulletin board **shall** consist of:

1.   Date and time of occurrence

2.   Duration of outage event

3.   Service affecting or non service-affecting

4.   Notification/posting time

5.   Network element affected

6.   Description

7.   Resolution.

[R5-3.: CertAss]   Average Service Restoration Time Metric

R   The ANX CSP/ANX CEPO **shall** meet the average service restoration time of 4 hours maximum for network elements and fiber cuts.

Included in the average service restoration time is all the time to detect the problem, to isolate the problem, and to restore service. Once service has been restored, the clock stops.

Measurement Technique:

R   For each outage event, the duration of the event **shall** be one of the reported parameters. This is a direct measure of the service restoration time from the ANX Subscribed TP viewpoint. The ANX CSP/ANX CEPO Applicants **shall** calculate and report to the ANXO the average duration of all service-affecting outage events.

[R5-4.: CertAss]   Total Network Outage Events Metric

A total network outage is defined as a major service interruption that prevents all of the ANX Subscribed TPs from accessing the network for at least 30 seconds. The number of these total network outage events for the network is a simple count of the number of occurrences in a time period on the ANX CSP/ANX CEPO network. The number of events is then split up by major type of network location (router, fiber optic cable, etc.).

R   The total number of total network outage events per year on the ANX CSP/ANX CEPO network that isolates all the ANX Subscribed TPs for over 30 seconds **shall** not exceed 10 per year.

Measurement Technique:

R   Information on all total network outage events in the ANX CSP/ANX CEPO Applicant's network **shall** be collected by the ANX CSP/ANX CEPO Applicant's event data collection system and the number of total network outage events **shall** be graphed by the ANX CSP/ANX CEPO Applicant and reported to the ANXO on a quarterly basis on a control chart. Alternatively, the estimate may be predicted using the prediction method described in Section 5.3.1.5. The graphs **shall** contain the control limits that indicate that the number of total network outage events does not meet the Criterion. The number of total network outage events by major types **shall** also be graphed.

5.3.2 ANX CSP

5.3.2.1 ANX CSP Overall Network Availability

ANX CSP network availability is defined as the proportion of time that the ANX CSP network is "up" for an ANX Subscribed TP. The overall ANX CSP network needs to perform seamlessly. It should be perceived to be "up" almost all of the time. This metric takes into consideration the duration of outage events, the nature of outage events (i.e., service affecting or non-service affecting), and the number of ANX Subscribed TP users affected by the events. It also takes into consideration the architecture of the ANX CSP network, including redundancy that is built into the network elements and into the network architecture.

[R5-5.: CertAss]   ANX CSP Overall Network Availability Metric

R   The ANX CSP network **shall** be available 99.97% of the time (all but 2.63 hours per year). This is an annual requirement averaged over all ANX Subscribed TPs served by the ANX CSP. This requirement is obtained by summing the targets of the unavailability of the ANX CSP backbone (99.99% availability) and the unavailability of the two ANX CSP edge (or border) routers (99.99% availability).

This requirement applies to the overall ANX CSP network, defined as between (and including) the ingress and egress routers at the network edges where the network interfaces with the ANX Subscribed TP Access Network and the ANX CEPO and/or other ANX CSP networks.

Measurement Technique:

R   The overall average annual network availability **shall** be computed by summing the unavailability of the ANX CSP Applicant's backbone and the unavailability of the two edge (or border) routers of the ANX CSP Applicant, and annualizing the measurements. Data reporting and metrics calculations **shall** conform to the methods specified in Section 5.3.1.

5.3.2.2 ANX CSP-to-ANX CEPO Trunk Availability (ANX CSP Responsibility)

When exceptions to the reference architecture occur with respect to the ANX CSP-to-ANX CEPO trunk, the unavailability requirements may be allocated between the ANX CSP and ANX CEPO based on the actual deployed architecture, with the common agreement of all the parties involved and the ANXO. It is anticipated that the unavailability allocation for network elements and facilities will be apportioned among the parties involved as a percentage in proportion to their responsibility for acquiring and/or maintaining those elements or facilities.

To reflect exceptions to the reference architecture, the factor AUT represents "Allocated Unavailability - ANX CSP-to-ANX CEPO trunk" as a percentage of the trunk unavailability allocated to the ANX CEPO. Unless other arrangements are reported to the ANXO, the ANXO will assume AUT = 50%.

[R5-6.: CertAss]   Overall Unavailability Metric for ANX CSP-to-ANX CEPO Trunk Availability (ANX CSP Responsibility)

R   The average availability of overall ANX CSP-to-ANX CEPO trunk access that is the responsibility of the ANX CSP (combined availability of primary and back-up trunks, considering AUT) **shall** be at least 99.99% (all but (0.88 x (100 - AUT)%) hour per year, equivalent to (52.6 x (100 - AUT)%) minutes per year). This requirement is obtained by computing the anticipated simultaneous unavailability of a primary and back-up trunk. Individual trunk downtimes for a primary and back-up trunk are assumed to be 43.80 hours per year (i.e., 0.5% unavailability), giving an expected combined availability of 99.9975%. The

required annual availability is less than the anticipated average availability to accommodate random variability in outage occurrences.

Measurement Technique:

R   The ANX CSP Applicant **shall** calculate and report to the ANXO the ANX Network Service unavailability caused by service affecting outage events that involve outages of any portion of the ANX CSP-to-ANX CEPO trunk that is the responsibility of the ANX CSP Applicant, using the methods specified in Section 5.3.1, with this modification: Before computing the annualized availability, the ANX CSP Applicant **shall** divide the annualized unavailability by (100 - AUT)%. The value of AUT **shall** be 50% unless a written agreement between both the ANX CSP and ANX CEPO states otherwise. In that case, the written agreement **shall** be provided to the ANXO during the ANX Certification Assessment of the ANX CSP Applicant. The ANX CEPO and ANX CSP Applicant **shall** report to the ANXO the specific demarcation point between the ANX CEPO responsibility and ANX CSP responsibility, in writing.

5.3.3 ANX CEPO

In the reference architecture shown in Figure 5-1, the ANX CEPO operates a primary and a back-up switch or a network of interconnected ATM switches plus the ANX CSP-to-ANX CEPO access trunks which provide critical interconnection functionality for the ANX CSPs in the ANX network.

5.3.3.1 ANX CEP Service Availability

[R5-7.: CertAss]   ANX CEPO Service Overall Availability Metric

R   The availability of overall ANX CEPO switching functionality **shall** be at least 99.995% (all but 0.44 hour per year, equivalent to 26 minute per year). This requirement is obtained by computing the anticipated simultaneous unavailability of a primary and back-up ANX CEP switch. Individual switch downtimes for a primary and back-up switch are assumed to include 35 hours per year planned downtime (i.e., 0.4% unavailability attributable to planned outages) and 8.76 hour per year unplanned downtime (i.e., 0.1% unavailability attributable to unplanned outages), giving an expected combined availability of 99.9995%. The required annual availability is less than the anticipated average availability to accommodate random variability in outage occurrences.

Measurement Technique:

R   The ANX CEPO Applicant **shall** calculate and report to the ANXO the ANX Network Service unavailability caused by service affecting outage events that involve outages of either the primary or back-up ANX CEP switch, or both, using the methods specified in Section 5.3.1.

5.3.3.2 ANX CSP-to-ANX CEPO Trunk Availability (ANX CEPO Responsibility)

When exceptions to the reference architecture occur with respect to the ANX CSP-to-ANX CEPO trunk, the unavailability requirements may be allocated between the ANX CSP and ANX CEPO based on the actual deployed architecture, with the common agreement of all the parties involved and the ANXO. It is anticipated that the unavailability allocation for network elements and facilities will be apportioned among the parties involved as a percentage in proportion to their responsibility for acquiring and/or maintaining those elements or facilities.

To reflect exceptions to the reference architecture, the factor AUT represents "Allocated Unavailability - ANX CSP-to-ANX CEPO trunk" as a percentage of the trunk unavailability allocated to the ANX CEPO. Unless other arrangements are reported to the ANXO, the ANXO will assume AUT = 50%.

[R5-8.: CertAss]   Overall Unavailability Metric for ANX CSP-to-ANX CEPO Trunk Availability (ANX CEPO Responsibility)

R   The availability of overall ANX CSP-to-ANX CEPO trunk access that is the responsibility of the ANX CEPO (combined availability of primary and back-up trunks, considering AUT) **shall** be at least 99.99% (all but (0.88 x average AUT%) hour per year, equivalent to (52.6 x average AUT%) minutes per year). This requirement is obtained by computing the anticipated simultaneous unavailability of a primary and back-up trunk. Individual trunk downtimes for a primary and back-up trunk are assumed to be 43.80 hours per year (i.e., 0.5% unavailability), giving an expected combined availability of 99.9975%. The required annual availability is less than the anticipated average availability to accommodate random variability in outage occurrences.

Measurement Technique:

R   The ANX CEPO Applicants **shall** report the ANX Network Service unavailability caused by service affecting outage events that involve outages of any portion of the ANX CSP-to-ANX CEPO trunk that is the responsibility of the ANX CEPO Applicant, using the methods specified in Section 5.3.1, with this modification: Before computing the annualized availability, the ANX CEPO Applicant **shall** divide the annualized unavailability by AUT%. The value of AUT **shall** be 50% unless a written agreement between both the ANX CSP and ANX CEPO Applicant states otherwise. In that case, the written agreement **shall** be provided to the ANXO during the ANX Certification Assessment of the ANX CEPO Applicant. The ANX CEPO Applicant and ANX CSP **shall** report to the ANXO the specific demarcation point between the ANX CEPO responsibility and ANX CSP responsibility, in writing.

5.3.4 Access Network

The Access Network may consist of a router and dedicated access line (such as a T1 line or a switched network such as Frame Relay) between the ANX Subscribed TP's local network and the ANX CSP ingress router. If this network fails the ANX Subscribed TP will be isolated and unable to access the ANX CSP. Other access methods such as dialup lines may also be used by the ANX Subscribed TP additionally, but reliability requirements are not defined in this document for such alternate access types.

5.3.4.1 Determining ANX CSP Responsibility for the Access Network

The availability of the Access Network depends on the technology used for the access line, the distance and geographic location, the access provider and whether or not the ANX Subscribed TP provides ready access to the router for maintenance. The reference architecture in Figure 5-1 assumes that the ANX CSP provides and manages the access line(s) and site router(s) for the ANX Subscribed TP. Under this assumption, the ANX CSP is responsible for the availability of the Access Network. However, several conditions may make it difficult or impossible for the ANX CSP to guarantee the availability of the access line to the ANX Subscribed TP. These conditions are:

1.   Lack of Access: The ANX Subscribed TP makes it difficult for the ANX CSP to gain access to the router on the ANX Subscribed TP's site, for maintenance purposes. The service agreement should spell out the minimal conditions which constitute "adequate" access.

2.   Third-Party Access Line: The ANX Subscribed TP obtains the access line from a third party other than the ANX CSP, and the ANX CSP has no control over the availability of the third-party provided access line.

3.   Third-Party ANX Subscribed TP Site Router: The ANX Subscribed TP obtains the router from a third party other than the ANX CSP, and the ANX CSP has no control over the availability of the router.

To reflect exceptions to the reference architecture, the factor AUL represents "Allocated Unavailability - ANX Subscribed TP-to-ANX CSP access link" as a percentage of the access network unavailability allocated to the ANX CSP. Unless other arrangements are reported to the ANXO, the ANXO will assume AUL = 100%.

5.3.4.2 Access Network Availability Metrics

The availability of the Access Network will vary over a wide range.

At the upper end of the availability scale, where (1) the ANX Subscribed TP premises router is accessible to the ANX CSP and well maintained and has an estimated availability of at least

99.99% (all but 53 minutes per year), and (2) the access line availability is estimated (as provided by the telecom network base-line *objectives* in [Part 6, Ref# 15]) to be at least 99.99% (all but 53 minutes per year), then the overall availability of this "best case" Access Network is estimated to be at least 99.98% (all but 106 minutes per year).

At the lower end of the availability scale where (1) the ANX Subscribed TP-site router may not be accessible to the ANX CSP or as well maintained and (2) the access line has much lower availability, then the estimated availability of this "worst case" Access Network, based on industry practice may be as low as 99.5% (all but 43.8 hours per year).

With respect to objectives for Access Network availability, as provided by third party carriers, carriers can be expected to set availability objectives so that only a small percentage of customers are likely to experience service poorer than the objective. The average service level is likely to be significantly better than the objective. Recognizing the anticipated variability in access link availability, the following ANX requirements apply:

[R5-9.: CertAss]   Average Access Network Availability Requirement Metric

R   The Access Network, on the average (averaged across all ANX Subscribed TP Access Networks, and considering AUL), **shall** be available at least 99.5% of the time (all but (43.8 x average AUL%) hours per year) for that portion of the Access Network provided by the ANX CSP.

Measurement Technique:

R   For ANX Certification Assessment purposes, the ANX CSP Applicant **shall** calculate and report to the ANXO the average unavailability of the Access Networks for which the ANX CSP Applicant is responsible using the methods specified in Section 5.3.1, with this modification: Before computing the annualized availability, the ANX CSP Applicant **shall** divide the annualized unavailability by AUL%. The value of AUL **shall** be 100% unless a written agreement between both the ANX CSP Applicant and ANX Subscribed TP states otherwise. In that case, the written agreement **shall** be provided to the ANXO during the ANX Certification Assessment of the ANX CSP Applicant. If the value of AUL is anything other than 100%, the ANX CSP Applicant and ANX Subscribed TP **shall** report to the ANXO the specific demarcation point between the ANX CSP Applicant's responsibility and ANX Subscribed TP responsibility, in writing, including written approval by the ANX Subscribed TP.

[R5-10.: CertAss]   Average Access Network Availability Objective Metric

R   The ANX CSP **shall** make all reasonable efforts to attain the objective that the Access Network, on the average (averaged across all ANX Subscribed TP Access Networks, and considering AUL), be available at least 99.8% of the time (all but (17.5 x average AUL%) hours per year) for that portion of the Access Network provided by the ANX CSP. If measured Access Network availability fails to meet the objective, the ANX CSP **shall** document the problems that cause the

metric to miss the objective, **shall** document planned improvements to improve the metric in the next reporting period, **shall** prepare numerical results that compare measured results with the objective and with results from the previous reporting period, and **shall** document progress in implementing planned improvements. The ANX CSP **shall** submit this documentation to the ANXO. The purpose of the documentation is to demonstrate that the ANX CSP meets the requirement that it make all reasonable efforts to attain the objective.

Measurement Technique:

R For ANX Certification Assessment purposes, the ANX CSP Applicant **shall** calculate and report to the ANXO the average unavailability of the Access Networks for which the ANX CSP Applicant is responsible, using the methods specified in Section 5.3.1, with this modification: Before computing the annualized availability, the ANX CSP Applicant **shall** divide the annualized unavailability by AUL%. The value of AUL **shall** be 100% unless a written agreement between both the ANX CSP Applicant and ANX Subscriber TP states otherwise. In that case, the written agreement **shall** be provided to the ANXO during the ANX Certification Assessment of the ANX CSP Applicant. If the value of AUL is anything other than 100%, the ANX CSP Applicant and ANX Subscribed TP **shall** report to the ANXO the specific demarcation point between the ANX CSP Applicant's responsibility and ANX Subscribed TP responsibility, in writing, including written approval by the ANX Subscribed TP.

[R5-11.: CertAss]   Minimum Access Network Availability Objective Metric

R The ANX CSP **shall** make all reasonable efforts to attain the objective that the Access Network availability for any individual ANX Subscribed TP Access Network be at least 99.5% of the time (all but (43.8 x AUL%) hours per year) for that portion of the Access Network provided by the ANX CSP. If measured Access Network availability fails to meet the objective, the ANX CSP **shall** document the problems that cause the metric to miss the objective, **shall** document planned improvements to improve the metric in the next reporting period, **shall** prepare numerical results that compare measured results with the objective and with results from the previous reporting period, and **shall** document progress in implementing planned improvements. The ANX CSP **shall** submit this documentation to the ANXO. The purpose of the documentation is to demonstrate that the ANX CSP meets the requirement that it make all reasonable efforts to attain the objective.

Measurement Technique:

R For ANX Certification Assessment purposes, the ANX CSP Applicant **shall** calculate the unavailability of the Access Networks for which it is responsible, for each individual Access Network, using the methods specified in Section 5.3.1, with this modification: before computing the annualized availability, the ANX CSP Applicant **shall** divide the annualized unavailability for each Access Network by the AUL% for that specific Access Network. The ANX CSP Applicant **shall** then report the total number of Access Networks served by that ANX CSP

Applicant and the Access Network identifier and annualized unavailability for all Access Networks for which the annualized unavailability is greater than 0.5%.

5.3.4.2.1 Additional Provisions for Improved Access Network Availability

Thus, the availability of the Access Network is expected to range between 99.5% in the worst case to over 99.98% in the best case. This range of expected performance represents the "standard" service offering for the ANX. Obviously this range of performance may have a large negative influence on some ANX Subscribed TPs. If a particular ANX Subscribed TP need better availability performance than provided by this "standard" offering, then it will be necessary for the ANX Subscribed TPs to obtain a better Access Network, either:

1. by working with the ANX CSP to obtain a customized solution from the ANX CSP which improves the performance of the ANX CSP-supplied Access Network, perhaps at a premium price, or

2. by working directly with router suppliers and/or work with the ANX CSP and the access line provider(s) to custom-engineer an Access Network that provides a "premium" grade of availability service to fit the needs of the ANX Subscribed TP. In this case, the ANX CSP will no longer be responsible for the performance of that ANX Subscribed TP's Access Network.

There are several ways to improve the availability of the Access Network. One way is to use conditioned access lines, which are custom engineered or selected for their superior performance.

Another way to improve availability is to use a backup access network. If done correctly, to ensure router redundancy, provide adequate traffic capacity and fast changeover, and provide access line physical and electrical route diversity, a backup can raise the Access Network availability to virtually 100%.

If the ANX Subscribed TP chooses, multi-homing (one implementation approach to backup) can be used to improve this availability.

When considering undertaking an effort to improve the Access Network availability, the ANX Subscribed TP should realize that, since the ANX Traffic on the network is between pairs of ANX Subscribed TPs, any single ANX Subscribed TP using an improved Access Network may not realize all the benefits unless all the ANX Subscribed TPs interacted with also opt for this or some comparable improvement.

5.3.5 Critical ANX Network S rvices

[R5-12.: CertAss]   ANX-enabled Domain Name Service Overall Availability Metric

R The availability and accessibility of the overall ANX-enabled Domain Name Service provided by primary and back-up ANX-enabled Domain Name Servers **shall** be at least 99.995% (all but 0.44 hour per year, equivalent to 26 minutes per year). This metric is obtained by computing the anticipated simultaneous unavailability of a primary and back-up ANX-enabled Domain Name Server. Individual unavailability or inaccessibility for a primary and back-up ANX-enabled Domain Name Server are assumed to include 35 hours per year planned downtime (i.e., 0.4% unavailability attributable to planned outages) and 8.76 hour per year unplanned downtime (i.e., 0.1% unavailability attributable to unplanned outages), giving an expected combined availability of 99.9995%. The required annual availability is less than the anticipated average availability to accommodate random variability in outage occurrences.

Measurement Technique:

R   ANX CSP Applicants or ANX CEPO Applicants operating ANX-enabled Domain Name Service
.   **shall** calculate and report to the ANXO the availability of the ANX-enabled Domain Name
     Service, reflecting any unavailability caused by outage events that involve outages of either the
     primary or back-up ANX-enabled Domain Name Server, or both, using the methods specified in
     Section 5.3.1.

[R5-13.: CertAss]   ANX Route Service Overall Availability Metric

R   The availability and accessibility of the overall ANX Route Service offered by two or more ANX
     Route Servers **shall** be at least 99.999% (all but 0.09 hours per year or 5.3 minutes per year).
     This metric is obtained by computing the anticipated simultaneous unavailability of a primary
     and back-up ANX Route Server. Individual unavailability or inaccessibility for a primary and
     back-up ANX Route Server are assumed to include 17.5 hours per year downtime (i.e., 0.2%
     unavailability). This metric is obtained by computing the anticipated simultaneous unavailability
     of a primary and back-up ANX Route Server. Individual unavailability or inaccessibility for a
     primary and back-up ANX Route Server are assumed to include 17.5 hours per year planned
     downtime (i.e., 0.2% unavailability attributable to planned outages) and 8.76 hour per year
     unplanned downtime (i.e., 0.1% unavailability attributable to unplanned outages), giving an
     expected combined availability of 99.9997%. The required annual availability is less than the
     ᵗ   anticipated average availability to accommodate random variability in outage occurrences. ANX
     Route Service availability requirements are more stringent than ANX-enabled Domain Name
     Service requirements because any loss of ANX Route Service for more than 3 minutes will cause
     loss of all ANX routing capability.

Measurement Technique:

R   ANX CEPO Applicants operating ANX Route Service **shall** calculate and report to the ANXO
     the ANX availability of ANX Route Service, reflecting any unavailability caused by outage
     events that involve outages of either the primary or back-up ANX Route Server, or both, using
     the methods specified in Section 5.3.1.

5.4 ANX Certification Verification Requirements

The requirements in this section are in general identical to those in the previous section. They are
repeated for the sake of completeness. The only difference is that ANX Certification Verification
can only be done using collected outage data. The use of prediction models which was permitted
for the ANX Certification Assessment phase is not acceptable for ANX Certification
Verification.

5.4.1 R liability Metrics Calculation and Reporting Requirements for ANX CSPs and ANX CEPOs

This section specifies outage and reliability reporting requirements common to ANX CSPs and ANX CEPOs.

5.4.1.1 Outage Event Data Collection

R ANX CSP and ANX CEPO data collection and metric calculation **shall** comply with outage data collection and reporting methods specified in Section 5.3.1.3.

5.4.1.2 Calculation of Availability

R For metrics requiring the calculation of availability, the ANX CSP and ANX CEPO **shall** calculate availability, and report calculated results to the ANXO each quarter using the methods specified in Section 5.3.1.4.

5.4.1.3 Metrics Calculation for ANX Certification Verification

R For purposes of ANX Certification Verification, the calculations **shall** be based on a moving average from the most recent four quarters of data, or a moving average from all quarters if fewer than four quarters of data are available.

5.4.1.4 Metrics Evaluation Procedure

Whenever the measured of the metric fails to meet the required Criterion the ANXO will initiate ANXO Trouble Handling. For the specific metrics in Section 5.4, the Trouble Timer is redefined as 3 months instead of 30 days. At the end of each quarter, the ANXO will follow the following decision procedure:

1. If the four-quarter moving average of the metric meets the required Criterion, the ANX CSP or ANX CEPO is certified with respect to that metric.

2. If the ANX CSP or ANX CEPO is certified and the four-quarter moving average of the metric fails to meet the required Criterion, the ANX CSP or ANX CEPO will move into trouble resolution with respect to that metric.

3. If the ANX CSP or ANX CEPO is in trouble resolution and the annualized value of the metric for the most recent quarter meets the required Criterion, but the four-quarter moving average for the metric fails to meet the required Criterion, the ANX CSP or ANX CEPO remains in trouble resolution with respect to that metric.

4. If the ANX CSP or ANX CEPO is in trouble resolution and the annualized value of the metric for the most recent quarter fails to meet the required Criterion, the ANX CSP or ANX CEPO **shall** be placed on Probation.

5. If the ANX CSP or ANX CEPO remains on Probation for three successive quarters and the four-quarter moving average of the metric fails to meet the required Criterion at the end of the third successive probationary period, certification for the ANX CSP or ANX CEPO will be revoked.

Note that the impact of an isolated catastrophic outage event will be removed from the four-quarter moving average after four quarters.

[R5-1.: CertVer]   Reliability Data Calculation/Reporting Requirements

R   ANX CSPs/ANX CEPOs **shall** follow the procedures described in Section 5.3.1, and **shall** comply with all the procedures and requirements stated in Sections 5.3.1.3 through 5.3.1.6 for calculating and reporting the reliability metrics that concern availability/unavailability of ANX Network entities defined by the Reference Architecture in Figure 5-1 and Figure 5-2.

Measurement Technique:

R   ANX CSPs/ANX CEPOs **shall** confirm compliance with all the procedures and requirements stated in calculating and reporting the availability metrics stated in Figure 5-2.

5.4.1.5 Outage Notification Requirement

[R5-2.: CertVer]   Inter-ANX CSP and ANX CEPO Outage Notification

R   The ANX CSP and ANX CEPO **shall** participate in an electronic bulletin-board style inter-ANX CSP and ANX CEPO Notification program that will be hosted by the ANXO to facilitate the troubleshooting of the ANX Network problems, outage events that affect the ANX Subscribed TPs. The outage event information provided by the ANX CSP or ANX CEPO will be accessible only by the ANXO, ANX CSPs, ANX CEPOs and ANX Subscribed TPs. The ANX CSP and ANX CEPO **shall** notify the other participating ANX CSPs and ANX CEPOs of significant scheduled and unscheduled outage events within its network. The ANX CSP or ANX CEPO reporting an outage **shall** submit the report to the ANXO as an IPSec-encrypted ASCII text e-mail message, and **shall** follow the instructions provided by the ANXO for posting an outage to the bulletin board.

Measurement Technique:

R   A significant outage event is defined as an outage event that lasts at least 30 minutes and that affects more than one trading partner, or any outage event that lasts at least 24 hours. ANX CSP and ANX CEPO **shall** commit to notify outages using ANXO-hosted electronic bulletin-board program at least 5 business days prior to significant scheduled outages, and within 48 hours of the occurrence of significant unscheduled outages as an incident report. ANX CSP and ANX CEPO **shall** test the interface to post a message to the bulletin board prior to ANX Certification

Assessment. The outage information reported on the ANXO-hosted electronic bulletin board **shall** consist of:

1. Date and time of occurrence

2. Duration of outage event

3. Service affecting or non service-affecting

4. Notification/posting time

5. Network element affected

6. Description

7. Resolution.

[R5-3.: CertVer]   Average Service Restoration Time Metric

R   The ANX CSP/ANX CEPO **shall** meet the average service restoration time of 4 hours for network elements and fiber cuts.

We include in the average service restoration time all the time to detect the problem, to isolate the problem, and to restore service. Once service has been restored, the clock stops.

Measurement Technique:

R   For each outage event, the duration of the event **shall** be one of the reported parameters. This is a direct measure of the service restoration time from the user's viewpoint. The ANX CSP/ANX CEPO **shall** calculate and quarterly report to the ANXO the average duration of all service-affecting outage events.

[R5-4.: CertVer]   Total Network Outage Events Metric

Total network outage is defined as a major service interruption that prevents all of the ANX Subscribed TPs from accessing the network for at least 30 seconds. The number of total network outage events for the network is a simple count of the number of such events in a time period on the ANX CSP/ANX CEPO network. The number of events is then split up by major type of network location (router, fiber optic cable, etc.).

R   The number of total network outage events per year on the ANX CSP/ANX CEPO network that isolates all the ANX Subscribed TPs for over 30 seconds **shall** not exceed 10 per year.

Measurement Technique:

R Information on all total service outage events in the ANX CSP/ANX CEPO network **shall** be collected by the ANX CSP/ANX CEPO data collection system and the number of total events **shall** be graphed by the ANX CSP/ANX CEPO and reported to the ANXO on a quarterly basis on a control chart. The graphs **shall** contain the control limits that indicate that the number of total service outage events does not meet Criterion. The number of total service outage events by major types **shall** also be graphed.

5.4.2 ANX CSP

5.4.2.1 ANX CSP Overall Network Availability

[R5-5.: CertVer]   ANX CSP Overall Network Availability Metric

R The ANX CSP network **shall** be available 99.97% of the time (all but 2.63 hours per year). This is an annual requirement averaged over all ANX Subscribed TPs served by the ANX CSP. This requirement is obtained by summing the targets of the unavailability of the ANX CSP backbone (99.99% availability) and the unavailability of the two ANX CSP edge (or border) routers (99.99% availability).

This requirement applies to the overall ANX CSP network, defined as between (and including) the ingress and egress routers at the network edges where the network interfaces with the ANX Subscribed TP Access Network and the ANX CEPO and/or other ANX CSP networks..

Measurement Technique:

R The overall average annual network availability **shall** be computed by summing the unavailability of the ANX CSP backbone and the unavailability of the two ANX CSP edge (or border) routers, and annualizing the measurements. Data reporting and metrics calculations **shall** conform to the methods specified in Section 5.3.1.

5.4.2.2 ANX CSP-to-ANX CEPO Trunk Availability (ANX CSP Responsibility)

[R5-6.: CertVer]   Overall Unavailability Metric for ANX CSP-to-ANX CEPO Trunk Availability (ANX CSP Responsibility)

R The average availability of overall ANX CSP-to-ANX CEPO trunk access that is the responsibility of the ANX CSP (combined availability of primary and back-up trunks, considering AUT) **shall** be at least 99.99% (all but (0.88 x (100 - AUT)%) hour per year, equivalent to (52.6 x (100 - AUT)%) minutes per year). This requirement is obtained by computing the anticipated simultaneous unavailability of a primary and back-up trunk. Individual trunk downtimes for a primary and back-up trunk are assumed to be 43.80 hours per

year (i.e., 0.5% unavailability), giving an expected combined availability of 99.9975%. The required annual availability is less than the anticipated average availability to accommodate random variability in outage occurrences.

Measurement Technique:

R The ANX CSP **shall** calculate and report to the ANXO the ANX Network Service unavailability caused by service affecting outage events that involve outages of any portion of the ANX CSP-to-ANX CEPO trunk that is the responsibility of the ANX CSP, using the methods specified in Section 5.3.1, with this modification: Before computing the annualized availability, the ANX CSP **shall** divide the annualized unavailability by (100 - AUT)%. The value of AUT **shall** be 50% unless a written agreement between both the ANX CSP and ANX CEPO, a copy of which is provided to the ANXO indicating the specific demarcation point between the ANX CEPO responsibility and ANX CSP responsibility, states otherwise.

5.4.3 ANX CEPO

5.4.3.1 ANX CEP Service Availability

[R5-7.: CertVer]   ANX CEP Service Overall Availability Metric

R The availability of overall ANX CEPO switching functionality **shall** be at least 99.995% (all but 0.44 hour per year, equivalent to 26 minute per year). This requirement is obtained by computing the anticipated simultaneous unavailability of a primary and back-up switch. Individual switch downtimes for a primary and back-up ANX CEP switch are assumed to include 35 hours per year planned downtime (i.e., 0.4% unavailability attributable to planned outages) and 8.76 hour per year unplanned downtime (i.e., 0.1% unavailability attributable to unplanned outages), giving an expected combined availability of 99.9995%. The required annual availability is less than the anticipated average availability to accommodate random variability in outage occurrences

Measurement Technique:

R The ANX CEPO **shall** calculate and report to the ANXO the ANX Network Service availability, reflecting any unavailability caused by service affecting outage events that involve outages of either the primary or back-up ANX CEP switch, or both, using the methods specified in Section 5.3.1.

5.4.3.2 ANX CSP-to-ANX CEPO Trunk Availability (ANX CEPO Responsibility)

[R5-8.: CertVer] Overall Unavailability Metric for ANX CSP-to-ANX CEPO Trunk Availability (ANX CEPO Responsibility)

R The availability of overall ANX CSP-to-ANX CEPO trunk access that is the responsibility of the ANX CEPO (combined availability of primary and back-up trunks, considering AUT) **shall** be at least 99.99% (all but (0.88 x average AUT%) hour per year, equivalent to (52.6 x average AUT%) minutes per year). This requirement is obtained by computing the anticipated simultaneous unavailability of a primary and back-up trunk. Individual trunk downtimes for a primary and back-up trunk are assumed to be 43.80 hours per year (i.e., 0.5% unavailability), giving an expected combined availability of 99.9975%. The required annual availability is less than the anticipated average availability to accommodate random variability in outage occurrences.

Measurement Technique:

R The ANX CEPO **shall** report the ANX Network Service unavailability caused by service affecting outage events that involve outages of any portion of the ANX CSP-to-ANX CEPO trunk that is the responsibility of the ANX CEPO, using the methods specified in Section 5.3.1, with this modification: Before computing the annualized availability, the ANX CEPO **shall** divide the annualized unavailability by AUT%. The value of AUT **shall** be 50% unless a written agreement between both the ANX CSP and ANX CEPO, a copy of which is provided to the ANXO indicating the specific demarcation point between the ANX CEPO responsibility and ANX CSP responsibility, states otherwise.

5.4.4 Access Network

[R5-9.: CertVer] Average Access Network Availability Requirement Metric

R The Access Network, on the average (averaged across all ANX Subscribed TP Access Networks, and considering AUL), **shall** be available at least 99.5% of the time (all but (43.8 x average AUL%) hours per year) for that portion of the Access Network provided by the ANX CSP.

Measurement Technique:

R For ANX Certification Verification purposes, the ANX CSP **shall** calculate and report to the ANXO the average unavailability of the Access Networks for which the ANX CSP is responsible, using the methods specified in Section 5.3.1, with this modification: Before computing the annualized availability, the ANX CSP **shall** divide the annualized unavailability by AUL%. The value of AUL **shall** be 100% unless a written agreement between both the ANX CSP and ANX Subscribed TP, a copy of which is provided to the ANXO indicating the specific demarcation point between the ANX CSP responsibility and the ANX Subscribed TP responsibility, states otherwise.

[R5-10.: CertVer]   Average Access Network Availability Objective Metric

R The ANX CSP **shall** make all reasonable efforts to attain the objective that the Access Network, on the average (averaged across all ANX Subscribed TP Access Networks, and considering AUL), be available at least 99.8% of the time (all but (17.5 x average AUL%) hours per year) for that portion of the Access Network provided by the ANX CSP. If measured Access Network availability fails to meet the objective, the ANX CSP **shall** document the problems that cause the metric to miss the objective, **shall** document planned improvements to improve the metric in the next reporting period, **shall** prepare numerical results that compare measured results with the objective and with results from the previous reporting period, and **shall** document progress in implementing planned improvements. The ANX CSP **shall** submit this documentation to the ANXO. The purpose of the documentation is to demonstrate that the ANX CSP meets the requirement that it make all reasonable efforts to attain the objective.

Measurement Technique:

R For ANX Certification Verification purposes, the ANX CSP **shall** calculate and report to the ANXO the average unavailability of the Access Networks for which the ANX CSP is responsible, using the methods specified in Section 5.3.1, with this modification: Before computing the annualized availability, the ANX CSP **shall** divide the annualized unavailability by AUL%. The value of AUL **shall** be 100% unless a written agreement between both the ANX CSP and ANX Subscribed TP, a copy of which is provided to the ANXO indicating the specific demarcation point between the ANX CSP responsibility and the ANX Subscribed TP responsibility, states otherwise.

[R5-11.: CertVer]   Minimum Access Network Availability Objective Metric

The ANX CSP **shall** make all reasonable efforts to attain the objective that the Access Network availability for any individual ANX Subscribed TP Access Network be at least 99.5% of the time (all but (43.8 x AUL%) hours per year) for that portion of the Access Network provided by the ANX CSP. If measured Access Network availability fails to meet the objective, the ANX CSP

shall document the problems that cause the metric to miss the objective, **shall** document planned improvements to improve the metric in the next reporting period, **shall** prepare numerical results that compare measured results with the objective and with results from the previous reporting period, and **shall** document progress in implementing planned improvements. The ANX CSP **shall** submit this documentation to the ANXO. The purpose of the documentation is to demonstrate that the ANX CSP meets the requirement that it make all reasonable efforts to attain the objective.

Measurement Technique:

R For ANX Certification Assessment purposes, the ANX CSP **shall** calculate the unavailability of the Access Networks for which it is responsible, for each individual Access Network, using the methods specified in Section 5.3.1, with this modification: before computing the annualized availability, the ANX CSP **shall** divide the annualized unavailability for each Access Network by the AUL% for that specific Access Network. The ANX CSP **shall** then report the total number of Access Networks served by that ANX CSP and the Access Network identifier and annualized unavailability for all Access Networks for which the annualized unavailability is greater than 0.5%.

5.4.5 Critical ANX Network Services

[R5-12.: CertVer]   ANX Domain Name Service Overall Availability Metric

R The availability and accessibility of the overall ANX-enabled Domain Name Service provided by primary and back-up ANX-enabled Domain Name Servers **shall** be at least 99.995% (all but 0.44 hour per year, equivalent to 26 minutes per year). This metric is obtained by computing the anticipated simultaneous unavailability of a primary and back-up ANX-enabled Domain Name Server. Individual unavailability or inaccessibility for a primary and back-up ANX-enabled Domain Name Server are assumed to include 35 hours per year planned downtime (i.e., 0.4% unavailability attributable to planned outages) and 8.76 hour per year unplanned downtime (i.e., 0.1% unavailability attributable to unplanned outages), giving an expected combined availability of 99.9995%. The required annual availability is less than the anticipated average availability to accommodate random variability in outage occurrences.

Measurement Technique:

R   ANX CSPs or ANX CEPOs operating ANX-enabled Domain Name Service **shall** calculate and report to the ANXO the ANX availability of ANX-enabled Domain Name Service, reflecting any unavailability caused by outage events that involve outages of either the primary or back-up ANX-enabled Domain Name Server, or both, using the methods specified in Section 5.3.1.

[R5-13.: CertVer]   ANX Route Service Overall Availability Metric

R   The availability and accessibility of the overall ANX Route Service provided by two or more ANX Route Servers **shall** be at least 99.999% (all but 0.09 hours per year or 5.3 minutes per year). This metric is obtained by computing the anticipated simultaneous unavailability of a primary and back-up ANX Route Server. Individual unavailability or inaccessibility for a primary and back-up ANX Route Server are assumed to include 17.5 hours per year downtime (i.e., 0.2% unavailability). This metric is obtained by computing the anticipated simultaneous unavailability of a primary and back-up ANX Route Server. Individual unavailability or inaccessibility for a primary and back-up ANX Route Server are assumed to include 17.5 hours per year planned downtime (i.e., 0.2% unavailability attributable to planned outages) and 8.76 hour per year unplanned downtime (i.e., 0.1% unavailability attributable to unplanned outages), giving an expected combined availability of 99.9997%. The required annual availability is less than the anticipated average availability to accommodate random variability in outage occurrences. ANX Route Service availability requirements are more stringent than ANX-enabled Domain Name Service requirements because any loss of ANX Route Service for more than 3 minutes will cause loss of all ANX routing capability.

Measurement Technique:

R   ANX CEPOs operating ANX Route Service **shall** calculate and report to the ANXO the ANX availability of ANX Route Service, reflecting any unavailability caused by outage events that involve outages of either the primary or back-up ANX Route Server, or both, using the methods specified in Section 5.3.1.

5.5 Summary of Reliability Requirements

Table 5-2 summarizes the certification requirements for Reliability.

ANX Certification Requirements For Reliability								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
5-	1	Yes	Yes	Reliability Data Collection and Reporting Requirements	Compliance	Yes	Quarterly	PDF
5-	2	Yes	Yes	Inter-ANX CSP and ANX CEPO Outage Notification	Compliance and Testing Completion	Yes	Quarterly	PDF
5-	3	Yes	Yes	Average Service Restoration Time	≤ 4 hours	Yes	Quarterly	PDF
5-	4	Yes	Yes	Total Network Outage Events	< 10 events per year lasting > 30 seconds each	Yes	Quarterly	PDF
5-	5	Yes	No	ANX CSP Overall Network Availability	≥99.97%	Yes	Quarterly	PDF
5-	6	Yes	No	Overall Unavailability Metric for ANX CSP-to-ANX CEPO Trunk Availability, ANX CSP Responsibility	≥ 99.99% for the portion of the trunking that is the responsibility of the ANX CSP	Yes	Quarterly	PDF
5-	7	No	Yes	Overall ANX CEPO Service Availability	≥ 99.995%	Yes	Quarterly	PDF
5-	8	No	Yes	Overall Unavailability Metric for ANX CSP-to-ANX CEPO Trunk Availability, ANX CEPO Responsibility	≥ 99.99% for the portion of the trunking that is the responsibility of the ANX CEPO	Yes	Quarterly	PDF
5-	9	Yes	No	Average Access Network Availability Requirement	≥ 99.5% for the portion of the Access Network that is the responsibility of the ANX CSP	Yes	Quarterly	PDF

5-	10	Yes	No	Average Access Network Availability Objective	≥ 99.8% for the portion of the Access Network that is the responsibility of the ANX CSP	Yes	Quarterly	PDF
5-	11	Yes	No	Minimum Access Network Availability Objective	≥ 99.5% for the portion of the Access Network that is the responsibility of the ANX CSP	Yes	Quarterly	PDF
5-	12	Yes	Yes	ANX-Enabled Domain Name Service Overall Availability	≥ 99.995%	Yes	Quarterly	PDF
5-	13	No	Yes	ANX Route Service Overall Availability	≥ 99.999%	Yes	Quarterly	PDF

Table 5-2: Reliability Requirements Summary

6. Business Continuity and Disaster Recovery Metrics

6.1 Scope

ANX Subscribed TPs expect that ANX CSPs/ANX CEPOs have taken reasonable precautions to prevent extended loss of service due to preventable conditions, and to minimize service disruptions if a disaster occurs. This section describes the business continuity and disaster recovery requirements an ANX CSP/ANX CEPO must meet.

A disaster is defined as any extended, unplanned loss of service provided by Certified Service Providers to ANX Subscribed TPs as a result of either a natural event (e.g., hurricane, flood, lightning, earthquake, etc.) or a human activity (e.g., sabotage, civil insurrection, procedural error requiring extended recovery time, etc.). A disaster will typically result in outages to one or more customer sites for one or more days.

A known potential disaster for the ANX Network Service is non-conformity of network elements and systems with the new Millennium dates, or four-digit dates, as the new Millennium is entered. It is imperative that ANX CSPs and CEPOs ensure that the Year 2000 conformity is securely implemented within their processes, for all hardware and software components utilized within their networks, as well as with regard to their products and suppliers before the change of date. This is critical to assure that the operation of ANX Network Service will not be put at risk by the change of date problem.

6.2 Approach and Methodology

A **Business Continuity/Disaster Recovery Plan** (BC/DRP) identifies service-affecting vulnerabilities so that those vulnerabilities with a low cost/benefit ratio can be eliminated, and provides procedures and information to be used to prevent extended service outages in case a disaster does occur. A BC/DRP is designed to provide immediate response to, and subsequent recovery from, any disaster. It is not a daily problem resolution procedure.

The assessment and verification approach and methodology for Business Continuity and Disaster Recovery is:

1. The ANX CSP/ANX CEPO provides periodic evidence of a satisfactory and up-to-date BC/DRP to the ANXO and redundancy precautions of ANX CSP/ANX CEPO NOC operations and facilities.

2. The ANX CSP/ANX CEPO tests the BC/DRP periodically and provides evidence of this test to the ANXO.

3. The ANXO verifies the adequacy of the BC/DRP.

4. The ANXO periodically audits the BC/DRP and BC/DRP tests and the redundancy precautions of ANX CSP/ANX CEPO NOC operations and facilities through onsite inspections.

6.2.1 Industry Analysis

The objectives of a BC/DRP are as follows:

1. To identify business continuity vulnerabilities for disaster prevention and recovery planning purposes.

2. To serve as a guide for disaster recovery teams.

3. To provide procedures and resources needed to recover business functions and the systems it supports.

4. To identify those vendors and customers that must be notified in the event of a disaster.

5. To identify alternate sources for supplies, resources, and locations.

6. To document storage, safeguarding and retrieval procedures for vital records.

6.3 ANX Certification Assessment Requirements

[R6-1.: CertAss]   Satisfactory Business Continuity and Disaster Recovery Plan (BC/DRP)

R   An ANX CSP/ANX CEPO **shall** develop and maintain a satisfactory BC/DRP for use as part of its ANX Network Service upon being ANX Certified. The BC/DRP **shall** include, but is not limited to, the strategy to be followed to recover from a disaster.

Measurement Technique:

R   The ANX CSP/ANX CEPO Applicant **shall** provide its BC/DRP to the ANXO and all disaster recovery team members prior to ANX Certification Assessment. The BC/DRP **shall** contain all of the following:

1. A list of business continuity vulnerabilities for disaster prevention and disaster recovery planning purposes.

2. The general strategy to be followed in recovering from a disaster.

3. A definition of the roles of the disaster recovery teams identified in the BC/DRP.

4. Specific procedures to be followed by each of the disaster recovery teams.

5. The composition of each of the disaster recovery teams, and how each can be reached by telephone (work, home, cellular), paging, fax, and electronic mail.

6. Specific locations to which each of the disaster recovery teams is to report in the event of a disaster.

7. A priority list of customers to be restored, to be used for service restoral order.

8. A priority list of sites to be restored in case of a widespread disaster.

9. A priority list of equipment to be restored at each site.

10. An inventory of equipment for each site.

11. A list of equipment vendors and their contact numbers (telephone, paging, fax, electronic mail).

12. A list of services vendors (commercial power, natural gas, water, etc.) and their contract numbers (telephone, paging, fax, electronic mail).

13. Flowcharts or procedures to be followed to restore temporary service, if necessary, after a disaster.

14. Flowcharts or procedures to be followed to restore normal service after a disaster.

15. Checklists to be used by the disaster recovery teams to assure all necessary components of the plan have been addressed, and all components completed.

[R6-2.: CertAss]   Secure Off-site Storage for Copies of BC/DRP

R   Copies of the BC/DRP **shall** be stored in a secure off-site location accessible immediately following a disaster.

Measurement Technique:

R   The ANX CSP/ANX CEPO Applicant **shall** provide ANXO proof of a secure off-site location and its immediate accessibility by disaster recovery team members.

[R6-3.: CertAss]   BC/DRP Walk-through Testing

R   Disaster recovery teams of an ANX CSP/ANX CEPO **shall** test the BC/DRP by means of a walk-through scenario.

Measurement Technique:

R   An ANX CSP/ANX CEPO Applicant **shall** present ANXO evidence that their BC/DRP is tested by means of a walk-through scenario by their disaster recovery teams. The ANX CSP/ANX CEPO Applicant **shall** present to the ANXO the walk-through scenario used, the results of the walk-through, and any updates to the BC/DRP that result from the walk-through. The ANX CSP/ANX CEPO Applicant **shall** cooperate with the ANXO audits on disaster recovery walk-thrus prior to ANX Certification Assessment.

[R6-4.: CertAss]   NOC Operations and Facilities Redundancy

R The ANX CSP/ANX CEPO **shall** implement suitable redundancy for its NOC operations and facilities that meet reliability requirements.

Measurement Technique:

R The ANX CSP/ANX CEPO Applicant **shall** provide evidence to the ANXO that it provides suitable redundancy for its NOC operations and facilities that meet reliability requirements.

[R6-5.: CertAss]   Automotive Industry Action Group's (AIAG's) Year 2000 Supply Continuity Process

In order to support the task to become Year 2000 conformant, AIAG provides a Year 2000 Supplier Self-Assessment Questionnaire (SAQ). In addition to the AIAG Year 2000 questionnaire, an addressing letter, and the guidelines are also provided. To obtain this package of information, contact Bob Bolo at rbolo@aiag.org or by fax at 248-223-5713.

R The ANX CSP/ANX CEPO Applicant who is seeking to be ANX Certified **shall** participate in the AIAG's Year 2000 Supply Continuity Process. As part of their ANX Certification Assessment process, the ANX CSP/ANX CEPO Applicant **shall** submit to the AIAG provided address, a completed SAQ via postal mail, at least six weeks prior to expiration of the ANX Certification Assessment timer.

The questionnaire can be used by the service provider as a self-assessment mechanism. Replies give valuable information on ANX Network service provider's own Year 2000 continuity procedures, detailed determination of service provider's own Year 2000 project status, and service provider's initiation of action.

Measurement Technique:

R The AIAG will store all the service provider replies centrally, evaluate them and provide results to the ANXO and the ANX CSP/ANX CEPO Applicant. The ANX CSP/ANX CEPO Applicant needs to pass AIAG evaluation with the outcome of Green or Yellow on a scale of {Green, Yellow, Red} regarding Year 2000 continuity. ANX Certification **shall** not be granted if this metric is failed, i.e. if a Red outcome is received.

6.4 ANX Certification Verification Requirements

[R6-1.: CertVer] Business Continuity and Disaster Recovery Plan (BC/DRP)

R An ANX CSP/ANX CEPO **shall** maintain a satisfactory BC/DRP for its ANX Network Service. The BC/DRP **shall** include, but is not limited to, the strategy to be followed to recover from a disaster. It **shall** also contain all of the BC/DRP itemized content identified as part of ANX

Certification Assessment requirements. The ANX CSP/ANX CEPO **shall** implement this plan if a disaster takes place.

Measurement Technique:

R An ANX CSP/ANX CEPO **shall** quarterly present evidence to the ANXO that their BC/DRP is reviewed and updated on a regular basis. The ANX CSP/ANX CEPO **shall** quarterly provide ANXO its updated BC/DRP which **shall** clearly indicate the updates, if any.

[R6-2.: CertVer] Secure Off-site Storage for Copies of BC/DRP

R Copies of the BC/DRP **shall** be stored in a secure off-site location accessible immediately following a disaster.

Measurement Technique:

R An ANX CSP/ANX CEPO **shall** quarterly present evidence that copies of the BC/DRP are stored in a secure off-site location accessible immediately by disaster recovery team members following a disaster.

[R6-3.: CertVer] BC/DRP Walk-Through Testing

R Disaster recovery teams of an ISP/EPO **shall** test the BC/DRP by means of a walk-through scenario at least once per year.

Measurement Technique:

R An ANX CSP/ANX CEPO **shall** quarterly present ANXO evidence that their BC/DRP is tested at least once per quarter by means of a walk-through scenario by their disaster recovery teams. The ANX CSP/ANX CEPO **shall** present to the ANXO the walk-through scenario used, the results of the walk-through, and any updates to the BC/DRP that result from the walk-through. The ANX CSP/ANX CEPO **shall** cooperate with the ANXO audits on disaster recovery walk-thrus (at least once every 3 years).

[R6-4.: CertVer] NOC Operations and Facilities Redundancy

R The ANX CSP/ANX CEPO **shall** implement suitable redundancy for its NOC operations and facilities that meet reliability requirements.

Measurement Technique:

R The ANX CSP/ANX CEPO **shall** quarterly provide evidence to the ANXO that the ANX CSP/ANX CEPO NOC provides suitable redundancy for NOC operations and facilities that meet reliability requirements.

[R6-5.: CertVer]Automotive Industry Action Group's (AIAG's) Year 2000 Supply Continuity Process

R   The ANX CSP/ANX CEPO **shall** participate in the AIAG's Year 2000 Supply Continuity Process. For ANX Certification Verification, the ANX CSP/ANX CEPO **shall** quarterly submit to the AIAG provided address, one of the following two documents via postal mail:

1. statement of no change since the previous submission, or

2. the updated AIAG Year 2000 SAQ (fully completed), if any milestones with respect to the AIAG's Year 2000 Supply Continuity Process have been achieved, or new problems have been identified that cause a change in any of the previously submitted replies.

Measurement Technique:

R   The AIAG will store all the service provider replies centrally, evaluate them and provide results to the ANXO. The ANX CSP/ANX CEPO must maintain the outcome of Green or Yellow on a scale of {Green, Yellow, Red} for each quarterly evaluation regarding Year 2000 supply continuity. The ANX CSP/ANX CEPO **shall** quarterly advise AIAG of their progress against their plan and **shall** report new problems discovered. Certification probation **shall** be entered if a Red outcome is received. The ANX CSP/ANX CEPO **shall** achieve a Green outcome by January 1st of Year 2000 to maintain its ANX Certified status.

6.5 Summary of Business Continuity and Disaster Recovery Requirements

Table 6-1 summarizes the certification requirements for business continuity and disaster recovery planning.

ANX Certification Requirements For BC/DRP								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
6-	1	Yes	Yes	Satisfactory BC/DRP	Compliance	Yes	Quarterly	PDF
6-	2	Yes	Yes	Secure off-site storage for copies of BC/DRP	Compliance	Yes	Quarterly	PDF
6-	3	Yes	Yes	BC/DRP walk-through testing with disaster recovery teams	Compliance	Yes	Quarterly	PDF
6-	4	Yes	Yes	NOC operations and facilities redundancy	Compliance	Yes	Quarterly	PDF
6-	5	Yes	Yes	AIAG's Year 2000 Supply Continuity Process	Compliance	Yes	Quarterly	questionnaire to AIAG via postal mail

Table 6-1: Business Continuity/Disaster Recovery Plan Certification Requirements Summary

7. Security Metrics

7.1 Scope

Any distributed computing environment spanning numerous organizations and connected to public facilities must be protected from attacks against the security of the network, the hosts connected to the network, and the sensitive data on the hosts. The ANX Network Service requires a common set of security assurances so that ANX Subscribed TPs can run their businesses across the network with a reasonable level of confidence of the security of the underlying ANX Network infrastructure. While TCP/IP is no more vulnerable to security attacks than other protocols without authentication (e.g., X.25, IPX, etc.), TCP/IP networks, like any other networks, have a number of potential security vulnerabilities. There have been a number of generic security measures commonly practiced in TCP/IP networks to defend against various types of attacks against the confidentiality and integrity of data on the network, as well as attempts to take over control of hosts. While new vulnerabilities are constantly being found, a strong underlying security practice can help prevent many types of attacks, quickly detect intrusions that are not prevented, and minimize the damage of intrusions that do occur.

The purpose of these security metrics is to describe the metrics and techniques that will be employed to ensure the effectiveness of the security practices of the ANX CSP/ANX CEPOs on the ANX Network. The ANXO will verify that a common set of security policies and practices are utilized by each ANX CSP. Furthermore, the ANXO will analyze the results of third-party security tests of the ANX CSP infrastructure to ensure the underlying security of the network.

7.2 Approach and Methodology

The security metrics introduced below directly apply to individual ANX CSP/ANX CEPO networks. While these metrics and Criteria are important in achieving or enhancing the security of an ANX CSP/ANX CEPO's network, they are also critical for its customers. Security issues, such as the guarding of passwords and limiting access of systems to authorized users, apply not only to the ANX CSP/ANX CEPOs, but also to the ANX Subscribed TPs who are the end users.

In fact, the primary guarantors of the security of ANX Subscribed TP data and hosts on the ANX Network are the ANX Subscribed TPs themselves. Internet Protocol Security (IPSec) will be used to encrypt, authenticate, and guarantee the integrity of the data across the ANX Network [Part 6, Ref# 16-20, 27-29]. IPSec will be applied at the endpoints of communication by the ANX Subscribed TPs at the originating and destination hosts, between two network gateways (i.e., firewalls or routers), or between a host and a gateway. With the data authenticated and encrypted by the ANX Subscribed TPs using IPSec, attacks against the ANX Network infrastructure controlled by the ANX CSP/ANX CEPOs will essentially be denial of service

attacks. If an attacker compromises the ANX Network Service by violating the security of the machines on an ANX CSP network, the sensitive ANX Subscribed TP data will not be viewable or alterable because it will be signed and sealed with IPSec. During such an attack, however, the intruder could potentially stop the flow of traffic or slow it down, resulting in a denial of service attack. Because of this denial of service possibility, the reliability and performance of the ANX Network are closely related to its security. The purpose of these metrics is to help ensure that security compromise of ANX CSP/ANX CEPO networks and the potential resulting denial of service attacks cannot occur.

To achieve this goal, ANX CSPs will provide summaries of various aspects of their security policy statements to the ANXO. The ANXO will then analyze these policies to ensure that they represent the security needs of the ANX Network. Additionally, the ANXO will require verification of the implementation of these security policies. To achieve this verification, each ANX CSP will use a trusted third-party security auditor to conduct a limited number of tests on their own network. These tests, which are limited in number and described in this metrics document, will focus on ensuring compliance with the metrics. The third-party security auditor will be chosen by the ANX CSP, subject to the approval of the ANXO. On a quarterly basis, the third-party security auditor will conduct the required tests (which may occur with the full knowledge and cooperation of the ANX CSP) and generate a report for the ANXO.

The metrics presented in this section are broken down into five categories, each with an associated assessment and verification approach and methodology:

1.   Authentication & Confidentiality

   a)   The ANX CSP/ANX CEPO provides periodic evidence of satisfactory and up-to-date authentication and confidentiality practices to the ANXO.

   b)   The ANXO will verify the adequacy of the evidence on authentication and confidentiality practices.

2.   Filtering

   a)   The ANX CSP/ANX CEPO will block source routed and spoofed packets.

   b)   The ANXO will periodically verify this filtering by launching source routed and spoofed packets into the ANX CSP network from ANX Subscribed TP interfaces.

3.   Suspicious Activity Detection

   a)   The ANX CSP/ANX CEPO must provide periodic evidence of its policy regarding the detection of intrusion into its network.

   b)   The ANX CSP/ANX CEPO must assure integrity of critical hosts, routers, and switches in its network such as DNS servers and mail servers.

c)   The ANXO will verify the adequacy of the evidence on suspicious activity detection practices.

4.   Interoperability Security Metrics

a)   The ANX CSP/ANX CEPO keeps the ANXO abreast of its security arrangements to protect the ANX Network and the ANX CEP at interconnection points.

b)   The ANXO will verify the adequacy of the evidence on interoperability practices.

7.3 Authentication & Confidentiality Metrics

7.3.1 Industry Analysis

A common safety practice for a network and computer systems is that it must only authenticate and allow access to identified users with unambiguous, unique user-IDs who have authorized user accounts. Administration guaranteeing authenticated user access is commonplace in industry today. Unfortunately, sometimes administrators become lax in their control and malicious users can gain access to systems that they should not be allowed to use. It has been known for years that weak (easy-to-guess) passwords have been one of the most often-used methods for gaining unauthorized access. Despite numerous warnings about enforcing password complexity, such attacks are still often very successful. For this reason, password complexity rules are viewed as offering a bare minimum level of security.

One-time passwords and strong cryptographic authentication are often being used to increase the security of authentication for users. While the metrics set forth in this section are concerned with increasing the security of passwords in use by an ANX CSP to manage its networking equipment, these additional, stronger means of authentication would be preferred for ensuring the identity of users.

In addition to determining who users are through authentication, achieving data integrity and confidentiality across the network are very relevant issues that can only be assured through digital signatures and encryption. Although encryption requires some processing overhead, it is a highly effective, tamper-resistant measure for protecting sensitive or private data transferred through the Internet. For encrypting data at the network level, the industry is rapidly moving to a set of standards known as IPSec, an abbreviation for Internet Protocol Security, which is defined in the Internet RFC series [Part 6, Ref# 16-20, 27-29].

7.3.2 ANX Certification Assessment Requirements

[R7-1.: CertAss]   Reusable Password Complexity Policy

Having a reasonable level of complexity to the reusable passwords for logging into ANX CSP/ANX CEPO hosts and routers benefits the ANX Subscribed TP community because it will limit one of the most common types of attacks against hosts and networks: password guessing.

R The ANX CSP/ANX CEPO **shall** implement a reusable password complexity policy for routers and hosts on its network that handle ANX Traffic. This policy **shall** specify that all reusable passwords be at least eight characters in length and contain one or more non-alphanumeric characters (e.g., !@#$%^&*). This policy **shall** require that passwords be expired on a regular, periodic basis. This policy **shall** also include use of one-time passwords or strong cryptographic authentication for the management of hosts and routers on the ANX CSP's/ANX CEPO's network.

Measurement Technique:

R The ANX CSP/ANX CEPO Applicant **shall** send to the ANXO a summary of its written policy regarding reusable password complexity for routers and hosts on its network that handle ANX Traffic, and use of one-time passwords or strong cryptographic authentication for the management of hosts and routers on its network.

[R7-2.: CertAss]   Support of Transmission of Encrypted Data Using IPSec and Oakley/ISAKMP Key Exchange

R The ANX CSP **shall** not hinder the transmission of encrypted data at the network (IP) level using the IPSec standards set forth in [Part 6, Ref# 16-20, 27-29] and associated documentation.

Measurement Technique:

R The ANX CSP Applicant **shall** commit in writing at ANX Certification Assessment to do nothing to hinder the transmission of encrypted data at the IP level using the IPSec standards and the Oakley/ISAKMP Key Exchange Protocol.

7.3.3 ANX Certification Verification Requirements

[R7-1.: CertVer]   Reusable Password Complexity Policy

R The ANX CSP/ANX CEPO **shall** implement a reusable password complexity policy for routers and hosts on its network that handle ANX Traffic. This policy **shall** specify that all reusable passwords be at least eight characters in length and contain one or more non-alphanumeric characters (e.g., !@#$%^&*). This policy **shall** require that passwords be expired on a regular, periodic basis. This policy **shall** also include use of one-time passwords or strong cryptographic

authentication for the management of hosts and routers on the ANX CSP's/ANX CEPO's network.

Measurement Technique:

R On a quarterly basis, the ANX CSP/ANX CEPO **shall** send to the ANXO a summary of its written policy regarding reusable password complexity and periodic password expiration for routers and hosts on its network. This written summary **shall** also include the ANX CSP/ANX CEPO policy regarding the use of one-time passwords or strong cryptographic authentication for the management of hosts and routers on its network.

[R7-2.: CertVer]   Support of Transmission of Encrypted Data Using IPSec and Oakley/ISAKMP Key Exchange

R The ANX CSP **shall** not hinder the transmission of encrypted data at the network (IP) level using the IPSec standards set forth in [Part 6, Ref# 16-20, 27-29] and associated documentation.

Measurement Technique:

R On a quarterly basis, the ANX CSP **shall** provide to the ANXO its written statement of continuing compliance with this requirement.

7.3.4 Summary of Authentication & Confidentiality Requirements

Table 7-1 summarizes the Authentication & Confidentiality metrics.

ANX Certification Requirements For Authentication & Confidentiality								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
7-	1	Yes	Yes	Reusable password complexity policy	Compliance	Yes	Quarterly	PDF
7-	2	Yes	No	Support of transmission of encrypted data using IPSec and Oakley/ISAKMP key exchange	Compliance	Yes	Quarterly	PDF

Table 7-1: Authentication and Verification Requirements Summary

7.4 Filtering

7.4.1 Industry Analysis

Numerous attacks occur on the Internet today based on impersonating an IP address (an action known as "IP spoofing"). Some ISPs block this type of attack by dropping packets at the perimeter of their networks if the packets have a source address other than that of the originating end network. By dropping such spoofed packet at the entry point into the network, this common type of attack is prevented. An additional attack that has been used for numerous years involves source routing, an option in the Internet Protocol that allows a source machine to specify the route a packet will take as it traverses a network. Source routing can be used to augment IP spoofing attacks and other malicious network activities. For these reasons, both spoofed IP packets and packets with the source routing option should be dropped by the ANX CSP.

To minimize the performance impacts of the filtering mechanism, an ANX CSP may choose to implement the blocking of source routing and spoofed packets at the edge router on the ANX Subscribed TP premises.

7.4.2 ANX Requirements for ANX Certification Assessment

[R7-3.: CertAss]   Spoofed Packets Blocking

R   An ANX CSP **shall** block spoofed packets from ANX Subscribed TPs. Packets from an ANX Subscribed TP with a source address other than the address space allocated to the ANX Subscribed TP **shall** be dropped. This filtering may be implemented at the edge router on the ANX Subscribed TP premises.

Measurement Technique:

R   The ANX CSP Applicant **shall** commit to block spoofed packets and provide a policy to the ANXO explaining how it will assure spoofed packets blocking from all ANX Subscribed TPs at ANX Certification Assessment.

[R7-4.: CertAss]   Source Routed Packets Blocking

R   An ANX CSP **shall** block source routed packets from ANX Subscribed TPs. Packets from an ANX Subscribed TP with the source routing option **shall** be dropped. This filtering may be implemented at the edge router on the ANX Subscribed TP premises.

Measurement Technique:

R   The ANX CSP Applicant **shall** commit to block source routed packets and provide a policy to the ANXO explaining how it will assure source routed packets blocking from all ANX Subscribed TPs at ANX Certification Assessment.

7.4.3 ANX C rtification Verification Requirements

[R7-3.: CertVer]   Spoofed Packets Blocking

R   An ANX CSP **shall** block spoofed packets from ANX Subscribed TPs. Packets from an ANX Subscribed TP with a source address other than the address space allocated to the ANX Subscribed TP **shall** be dropped.

Measurement Technique:

R   The ANX CSP **shall** quarterly provide ANXO its policy of assuring spoofed packets blocking. The ANX CSP **shall** inform ANXO of any changes in this policy or implementation of this policy, whenever changes occur.

[R7-4.: CertVer]   Source Routed Packets Blocking

R   An ANX CSP **shall** block source routed packets from ANX Subscribed TPs. Packets from an ANX Subscribed TP with the source routing option **shall** be dropped.

Measurement Technique:

R   The ANX CSP **shall** quarterly provide ANXO its policy of assuring source routed packets blocking. The ANX CSP **shall** inform ANXO of any changes in this policy or implementation of this policy, whenever changes occur.

7.4.4 Summary of Filtering Requirements

Table 7-2 summarizes filtering metrics.

ANX Certification Requirements For Authentication & Confidentiality								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
7-	3	Yes	No	Spoofed Packets Blocking	100%	Yes	Quarterly or when changes occur	PDF
7-	4	Yes	No	Source Routed packets Blocking	100%	Yes	Quarterly or when changes occur	PDF

Table 7-2: Filtering Requirements Summary

7.5 Suspicious Activity Detection

7.5.1 Industry Analysis

Although ANX CSPs and ANX Subscribed TPs are not required to report security attacks to other ANX CSPs, other ANX Subscribed TPs, or the ANXO, such reporting could be quite useful in understanding the scope of an attack, containing the damage, and recovering from the attack. At the option of the ANX CSP or ANX Subscribed TP, an attack can be reported to the ANXO, which will work with the attacked company or companies to inform other affected parties and to respond to the incident. With such cooperation, it is expected that security intrusions will be detected sooner and contained more readily.

The techniques for detecting suspicious activity described in the metrics in this section are commonly used to defend network and hosts today. Each metric specifies a policy that the ANX CSP should have in place to rapidly detect and contain intruders.

7.5.2 ANX Certification Assessment Requirements

A system integrity verification tool ensures that key operating system and configuration files have not been altered by unauthorized personnel. One of the quickest ways to detect network penetration is by the use of such tools. Typically, a form of cryptographic hashing is employed to detect alterations. One example of such a tool in the freeware domain is called Tripwire. Numerous commercial tools are also available.

[R7-5.: CertAss]   Use of System Integrity Verification Tools and Procedures

R The ANX CSP/ANX CEPO **shall** use system integrity verification tools and procedures.

Measurement Technique:

R The ANX CSP/ANX CEPO Applicant **shall** provide the ANXO with a summary of its written policy regarding the use of system integrity verification tools and procedures. The ANX CSP Applicant **shall** also provide a summary of its policy regarding the protection of the integrity of configuration of its hosts and routers.

[R7-6.: CertAss]   Checks for Unauthorized Network Monitoring Tools

R Network monitoring systems are software tools often installed by network administrators to monitor intrusion or other malicious activity on the network. However, such network monitoring software may also be installed by network intruders on host machines that record all information on the network segment where the host resides. The ANX CSP/ANX CEPO **shall** perform monthly checks for unauthorized network monitoring tools on its network.

Measurement Technique:

R The ANX CSP/ANX CEPO Applicant **shall** provide the ANXO a summary of its written policy governing regular checks for unauthorized network monitoring tools on its network.

7.5.3 ANX Certification Verification Requirements

[R7-5.: CertVer]   Use of System Integrity Verification Tools and Procedures

R The ANX CSP/ANX CEPO **shall** use system integrity verification tools and procedures.

Measurement Technique:

R On a quarterly basis or when the policy changes, the ANX CSP/ANX CEPO **shall** provide the ANXO with a summary of its written policy regarding the use of system integrity verification tools and procedures. The ANX CSP/ANX CEPO **shall** also provide a summary of its policy regarding the protection of the integrity of configuration of its hosts and routers.

[R7-6.: CertVer]   Monthly Checks for Unauthorized Network Monitoring Tools

R The ANX CSP/ANX CEPO **shall** perform monthly checks for unauthorized network monitoring tools on its network.

Measurement Technique:

R   On a quarterly basis or when the policy changes, the ANX CSP/ANX CEPO **shall** provide the ANXO a summary of its written policy governing regular checks for unauthorized network monitoring tools on its network.

7.5.4 Summary of Suspicious Activity Detection Requirements

Table 7-3 summarizes the suspicious activity detection metrics.

ANX Certification Requirements For Suspicious Activity Detection								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
7-	5	Yes	Yes	Use of system integrity verification tools and protection of integrity of host/router configurations	Compliance	Yes	Quarterly	PDF
7-	6	Yes	Yes	Monthly checks for unauthorized network monitoring tools	Compliance	Yes	Quarterly	PDF

Table 7-3: Suspicious Activity Detection Requirements Summary

7.6 Interoperability Security Metrics

7.6.1 Industry Analysis

When two networks are connected at an EP or through an ANX CSP-to-ANX CSP direct connection, additional security concerns arise due to the larger number of parties involved with the connection. Additional care is often required to protect these common sections of networks from intruders. This section contains requirements needed to secure these points of ANX CSP interaction in the ANX Network.

7.6.2 ANX Certification Assessment Requirements

[R7-7.: CertAss]   Protection of ANX CEP Network Infrastructure and Network Management Components

R   ANX CEPOs **shall** define and implement a protection policy to protect the ANX CEP network infrastructure and network management components from physical and over-the-network attacks.

Measurement Technique:

R ANX CEPO Applicants **shall** provide a written summary of its policy to protect the ANX CEP network infrastructure and network management components (from physical and over-the-network attacks).

[R7-8.: CertAss]   Integrity of Critical Systems

R The ANX CSP/ANX CEPO **shall** assure integrity of critical hosts, routers, switches and other systems in its administrative control such as DNS servers, Route Servers. Security attacks against such critical systems potentially impact multiple ANX Participants.

Measurement Technique:

R The ANX CSP/ANX CEPO Applicant **shall** provide the ANXO a summary of its policy governing integrity of critical systems in its network.

7.6.3 ANX Certification Verification Requirements

[R7-7.: CertVer]   Protection of ANX CEP Network Infrastructure and Network Management Components

R ANX CEPOs **shall** implement a protection policy to protect the ANX CEP network infrastructure and network management components from physical and over-the-network attacks.

Measurement Technique:

R ANX CEPOs **shall** deliver summaries of their documented policy for protecting the ANX CEP network infrastructure on a quarterly basis, or when the plans are updated.

[R7-8.: CertVer]   Integrity of Critical Systems

R The ANX CSP/ANX CEPO **shall** assure integrity of critical hosts, routers, switches and other systems in its administrative control such as DNS Servers, Route Servers, and similar services. Security attacks against such critical systems potentially impact multiple ANX Participants.

Measurement Technique:

R On a quarterly basis or when the changes occur, the ANX CSP/ANX CEPO **shall** provide the ANXO a summary of its policy governing integrity of critical systems in its network.

7.6.4 Summary of Interoperability Security Requirements

Table 7-4 summarizes the interoperability security metrics.

ANX Certification Requirements For Interoperability Security								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
7-	7	No	Yes	Protection of ANX CEP network infrastructure and network management components (from physical and over-the-network attacks)	Compliance	Yes	Quarterly or when changes occur	PDF
7-	8	Yes	Yes	Integrity of critical systems (DNS, RS, etc.)	Compliance	Yes	Quarterly or when changes occur	PDF

Table 7-4: Interoperability Security Requirements Summary

8. Customer Care / Help Desk Metrics

8.1 Scope

This section defines metrics for ANX CSP/ANX CEPO Service Quality for Customer Care and Help Desk. Help desk metrics for trouble handling are specified in Section 9 "Trouble Handling Metrics". The following areas are distinguished:

1.   Billing

2.   Service Activation

3.   Service Deactivation

The metrics for Help Desk performance for Trouble Handling is defined in the next chapter.

8.1.1 Industry Analysis

Customer Care and Help Desk consist of all functions that address the interface between customer and service provider regarding providing information, solving questions, and addressing customer problems. Typically, these functions include a billing contact point to address billing questions and problems, a contact point for service activation ("where do I sign up"), a contact point to address troubles while service is being provided, and a contact point for service deactivation. The Trouble Help Desk functions are addressed in Section 9. All other functions are addressed in this section.

The typical Help Desk functions consist of a combination of any or all of the following:

1.   Human representatives. Often different levels are distinguished to sort through FAQs versus questions that require expert attention.

2.   Automatic Call Distribution function (ACD). The ACD allows telephone callers to navigate to representatives with the correct expertise. ACDs also provide a queuing function when (human) representatives are busy. Furthermore, ACDs often provide automated answering on FAQs, or allow requests to be queued for later replies by the service provider.

3.   Electronic Bulletin Boards (e.g., WWW pages) and email interaction.

4.   On-line Trouble Ticketing systems accessible by customers.

5.   Other Customer Network Management functions that are accessible by customers and can aid them in problem resolution, e.g., ping/traceroute replies, SNMP based statistics, etc.

This document considers the human representative a mandatory capability. This document does not further constrain the exact mix of other Help Desk capabilities. Rather, service requirements are specified such that they address the service level that should be expected by customers, and they can be implemented through a combination of these functions.

The key metric of billing is a bill's accuracy. The Billing Help Desk considers questions regarding previous or future bills.

Maintaining metrics for Service Activation and Deactivation Help Desks is considered to be in the service provider's interest to ensure "good service". However, it is also in the user's interest, especially where rapid activation of subscriber lines is necessary for mission critical reasons. Metrics and target quality of these help desks vary in industry. Common metrics include Availability, Holding Time, and Installation Delay. However, in the interest of the ANX Subscribed TPs the ANX Network Service is working towards reasonable goals to ensure "good service".

Service Activation and Deactivation are processes of subscribing and unsubscribing users from the service and connecting and disconnecting their equipment from the network.

In addition, electronic Help Desks may be used for greater customer care. Examples include the WWW, on-line subscription and unsubscription, Customer Network Management services such as SNMP access to service provider metrics, etc.

8.2 Approach and Methodology

Metrics in this section apply to the Help Desk function as seen by ANX Subscribed TPs. The assessment and verification approach and methodology for Customer Care and Help Desk are:

1. The ANX CSP/ANX CEPO will measure Help Desk performance metrics and provides periodical statistics to the ANXO.

2. The ANXO will analyze the statistics and may periodically audit the ANX CSP/ANX CEPO through surveys and sample tests.

8.3 ANX Certification Assessment Requirements

8.3.1 Customer Care Help Desk

[R8-1.: CertAss] Customer Care Help Desk Scheduled Service Time

The Customer Care Help Desk Scheduled Service Time is the time that the Customer Care Help Desk is planned to be offered. This parameter is measured in days per week and hours per day.

R The Scheduled Service Time for the Customer Care Help Desk **shall** be at least nine (9) hours per day, from 9am to 6pm local time in each time zone in which an ANX CSP provides ANX Network Service to ANX Subscribed TPs, 5 days per week except during nationally recognized holidays.

Measurement Technique:

R The ANX CSP/ANX CEPO Applicant **shall** state compliance to this requirement in written form prior to certification.

[R8-2.: CertAss]   Customer Care Help Desk Availability

Customer Care Help Desk Availability is defined as the amount of time that the Customer Care Help Desk is available. The Availability is expressed as a percentage of the total scheduled service time that includes outages and repairs.

R The Customer Care Help Desk Availability **shall** be at least 99.5. .

Measurement Technique:

R The ANX CSP/ANX CEPO Applicant **shall** state compliance to this requirement in written form prior to certification.

[R8-3.: CertAss]   Customer Care Help Desk Blockage-or-Busy Ratio

The Customer Care Help Desk Blockage-or-Busy Ratio is defined as the probability that Customer Care Help Desk call center is blocked for prospective callers due to overload conditions or when the Holding Time to reach a person (when the services of a person is requested) exceeds 2 minutes.

R The Customer Care Help Desk Blockage-or-Busy Ratio **shall** be no greater than 5%.

Measurement Technique:

R The ANX CSP/ANX CEPO Applicant **shall** state compliance to this requirement in written form prior to certification.

8.3.2 Service Activation

Service Activation refers to the process of subscribing a user and installing and activating the user interface.

[R8-4.: CertAss]   Service Activation Delay

The ANX Subscribed TP and ANX CSP, or ANX CSP and ANX CEPO in the case of an ANX CEPO service, will agree on a point in time when service is being activated and billing starts. The Service Activation Delay is defined as the maximum delay between this point in time and the actual service activation time. This parameter is measured in hours.

R   The Service Activation Delay **shall** be no more than 4 hours. Service Activation **shall** be on the same business day. This assumes that appropriate premises equipment is already available at the ANX Subscribed TP, or ANX CSP, customer site and that the ANX Subscribed TP, or ANX CSP, is ready. Any delay caused by unavailability or malfunctioning of the premises equipment at the customer site **shall** not be counted against the 4-hour Service Activation Delay window.

Measurement Technique:

R   The ANX CSP/ANX CEPO Applicant **shall** state compliance to this requirement in written form prior to certification.

[R8-5.: CertAss]   On-Time Installation for ANX CSP Provided ANX Subscribed TP Premises Equipment

The ANX Subscribed TP Premises Equipment On-Time Installation is defined as the probability that the ANX Subscribed TP premises equipment is delivered, installed and tested at the customer premises within 4 hours of the time stated by the ANX CSP Help Desk. This parameter is measured as a percentage of all Service Activation ANX Subscribed TP premises equipment installations.

R   The ANX Subscribed TP Premises Equipment On-Time Installation **shall** be no less than 95%. Any postponement specifically requested/negotiated by the customer to the ANX CSP Help Desk stated installation time **shall** not be counted against the 4-hour installation time window.

Measurement Technique:

R   The ANX CSP Applicant **shall** state compliance to this requirement in written form prior to certification.

8.3.3 Service Deactivation

[R8-6.: CertAss]   Post-Deactivation Time Billing Days

This parameter is defined as the maximum number of days that the customer is billed after the requested deactivation date within contractual constraints.

R   The number of Post-Deactivation Time Billing Days **shall** be 0. An ANX Subscribed TP, or ANX CSP in the case of an ANX CEPO service, **shall** not be billed for service after the requested calendar day of service deactivation.

Measurement Technique:

R The ANX CSP/ANX CEPO Applicant **shall** state compliance to this requirement in written form prior to certification.

8.4 ANX Certification Verification Requirements

8.4.1 Customer Care Help Desk

[R8-1.: CertVer]   Customer Care Help Desk Scheduled Service Time

R The Scheduled Service Time for the Customer Care Help Desk **shall** be at least nine (9) hours per day, from 9am to 6pm local time in each time zone in which an ANX CSP provides ANX Network Service to ANX Subscribed TPs, 5 days per week except during nationally recognized holidays.

Measurement Technique:

R The ANX CSP/ANX CEPO **shall** provide ANXO quarterly reports (monthly breakdowns) of the Customer Care Help Desk Scheduled Service Time.

[R8-2.: CertVer]   Customer Care Help Desk Availability

R The Customer Care Help Desk Availability **shall** be at least 99.5%.

Measurement Technique:

R The ANX CSP/ANX CEPO **shall** provide ANXO quarterly reports (monthly breakdowns) of the Customer Care Help Desk Availability.

[R8-3.: CertVer]   Customer Care Help Desk Blockage-or-Busy Ratio

R The Customer Care Help Desk Blockage-or-Busy Ratio **shall** be no greater than 5%.

Measurement Technique:

R The ANX CSP/ANX CEPO **shall** provide ANXO quarterly reports (monthly breakdowns) of the Customer Care Help Desk Blockage-or-Busy Ratio.

8.4.2 Service Activation

[R8-4.: CertVer]   Service Activation Delay

R The Service Activation Delay **shall** be no more than 4 hours. Service Activation **shall** be on the same business day. This assumes that appropriate premises equipment is already available at the

ANX Subscribed TP, or ANX CSP, customer site and that the ANX Subscribed TP, or ANX CSP, is ready. Any delay caused by unavailability or malfunctioning of the premises equipment at the customer site **shall** not be counted against the 4-hour Service Activation Delay window.

Measurement Technique:

R The ANX CSP **shall** provide ANXO quarterly reports (monthly breakdowns) of the Service Activation Delay.

[R8-5.: CertVer] On-Time Installation for ANX CSP Provided ANX Subscribed TP Premises Equipment

R The ANX Subscribed TP Premises Equipment On-Time Installation **shall** be no less than 95%. Any postponement specifically requested/negotiated by the customer to the ANX CSP Help Desk stated installation time **shall** not be counted against the 4-hour installation time window.

Measurement Technique:

R The ANX CSP **shall** provide ANXO quarterly reports (monthly breakdowns) of the ANX Subscribed TP Premises Equipment On-Time Installation.

8.4.3 Service Deactivation

[R8-6.: CertVer] Post-Deactivation Time Billing Days

R The number of Post-Deactivation Time Billing Days **shall** be 0. An ANX Subscribed TP, or ANX CSP in the case of an ANX CEPO service, **shall** not be billed for service after the requested calendar day of service deactivation.

Measurement Technique:

R The ANX CSP/ANX CEPO **shall** provide ANXO quarterly reports (monthly breakdowns) of Post-Deactivation Time Billing Days.

8.5 Summary of Customer Care /Help Desk Requirements

Table 8-1 summarizes the certification requirements for Customer Care / Help Desk.

ANX Certification Requirements For Customer Care / Help Desk								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
8-	1	Yes	Yes	Customer Care Help Desk Scheduled Service Time	≥ 9 hours/day, 5 days/week (except for national holidays) ocal time in each time zone	Yes	Quarterly	PDF / Excel (using template Q-CCHDM.XLS
8-	2	Yes	Yes	Customer Care Help Desk Availability	≥ 99.5	Yes	Quarterly	PDF / Excel (using template Q-CCHDM.XLS
8-	3	Yes	Yes	Customer Care Help Desk Blockage-or-Busy Ratio	≤ 5%	Yes	Quarterly	PDF / Excel (using template Q-CCHDM.XLS
8-	4	Yes	Yes	Service Activation Delay	≤ 4 hours, same business day	Yes	Quarterly	PDF / Excel (using template Q-CCHDM.XLS
8-	5	Yes	No	On-Time Installation of ANX CSP-Provided ANX Subscribed TP Premises Equipment	≥ 95%	Yes	Quarterly	PDF / Excel (using template Q-CCHDM.XLS
8-	6	Yes	Yes	Post-Deactivation Time Billing Days	0 days	Yes	Quarterly	PDF / Excel (using template Q-CCHDM.XLS

Table 8-1: Customer Care / Help Desk Requirements Summary

9. Trouble Handling Metrics

9.1 Scope

This section defines the performance of ANX CSPs/ANX CEPOs in the handling of troubles. Troubles are either called in by ANX Subscribed TPs or detected by the service provider, in which case the service provider may act reactively to address the problem, or troubles may be detected in a proactive manner. Troubles are typically processed using a trouble ticket system that keeps track of the status of the trouble resolution. Thus, this section addresses both the performance of the Trouble Help Desk, as well as the performance of the service provider in resolving troubles.

9.1.1 Industry Analysis

Trouble handling procedures are followed by Internet Service Providers and EPOs when failures are detected or reported. A service provider's network operations center staff typically manages a set of processes which collect data from network components, respond to outage detections coming in over a variety of methods (e.g. customer calls and e-mail, alerts generated by monitoring tools, calls and e-mail from other Internet service providers, and from engineering and operations staff). The components of the trouble handling process include: a monitoring and data collection system, alerting systems, phone call handling system, e-mail servers and clients, a trouble ticket system for classification and follow-through, a contact database for trouble pass-along and escalation, and a query and reporting system for trouble ticket information.

These components and processes are used by all Internet providers, but to varying extents. Providers who have adequate trouble handling procedures are seen by customers as having a reliable service and one that can provide assurance that problems are handled efficiently and effectively.

Some metrics defined in this section are internally measured -- that is, they are not directly observable as performance or reliability as seen by an ANX Subscribed TP. However because of the variable quality of these procedures in the Internet Service Provider industry, it is important that trouble handling metrics be called out specifically.

9.2 Approach and Methodology

9.2.1 Trouble Handling Procedures/Role of Parties in the ANX

In the ANX Network, trouble handling systems are operated by ANX CSPs and ANX CEPOs. It is assumed that ANX Subscribed TPs will report troubles directly to the ANX CSP to which they subscribe, that ANX CSP will attempt to follow through by either resolving the problem or

reporting it to an appropriate party. ANX CSPs are thus responsible for the overall satisfaction of their customers, and should accordingly track problems until they are resolved, and keep the customers informed of progress and final resolution.

Similarly, ANX CEPOs also operate trouble handling procedures related to the service being provided to the ANX CSPs. Similar trouble handling systems must be operated by the ANX CEPOs. However, the ANX CEPO is responsible for traffic at the data link layer, as it flows between ANX CSPs directly attached to the ANX CEP, and only for a limited number of IP level services. Any IP routing, and inter-provider trouble pass-through issues are not the responsibility of the ANX CEPO except for troubles regarding the operation of ANX Route Servers and ANX-enabled Domain Name Service for the layer 3 interface addresses of ANX CSP routers for the ANX CEP connections.

The expected role of each party in the ANX system is summarized in the following: (See related requirements in Section 10.6.)

1.   ANX CSPs and ANX CEPOs operate trouble handling systems.

2.   ANX Subscribed TPs report problems to the ANX CSP with whom they subscribe.

3.   ANX CSPs accept Trouble Tickets related to ANX Subscribed TPs who are their customers. Further, ANX CSPs accept Trouble Tickets from other ANX CSPs, from ANX CEPOs, or from the ANXO.

4.   ANX CEPOs accept Trouble Tickets from ANX CSPs or from the ANXO. Problems reported to the ANX CEPO that indicate trouble in one or more ANX CSPs are reported to those ANX CSPs that are direct customers of the ANX CEPO.

It is anticipated that ANX CSPs and ANX CEPOs will work towards Trouble Ticket formats that are exchangeable between service providers for the next ANX Release.

9.2.2 Measurements

The methodology for Trouble Handling measurements is:

1.   The ANX CSP/ANX CEPO provides periodically its Trouble Handling and Escalation Policy.

2.   The ANXO analyzes the adequacy of the evidence.

3.   The ANX CSP/ANX CEPO provides periodic measurements data to the ANXO.

4.   The ANXO analyzes the periodic data.

The ANXO may periodically or randomly audit the ANX CSP/ANX CEPO NOC and Trouble Help Desk.

9.2.3 Trouble Sev rity Classifications

For purposes of discussing metrics for trouble handling, it is necessary to define severity levels for Trouble Tickets. Trouble in the ANX Network is defined from the point of view of the ANX Subscribed TP. Therefore, Trouble Tickets are grouped in the following five categories:

Class 1. **ANX Subscribed TP is out of service. Many or "all" ANX destinations are not reachable.**

Class 1 troubles shall be given the highest priority by the ANXO. It is typically related to an outage in an ANX CSP to which the ANX Subscribed TP is connected, or related to an ANX CEPO outage.

Class 2. **ANX Subscribed TP can not reach certain ANX destinations.**

Class 2 troubles may be caused by a variety of network problem types. Class 2 troubles include cases of reachability problems encountered by customers of other ANX CSPs. The ANX CSP shall be prepared to pass the problem along to another ANX CSP if necessary.

Class 3. **ANX Subscribed TP experiences poor service quality in communication.**

Class 3 troubles are not considered an outage but performance is affected, e.g., when an ANX Subscribed TP experiences degraded quality of service in communications with some or all destinations; and when an ANX CSP experiences degraded quality of service, but not complete disconnection, in communication with peers at an ANX CEP.

Class 4. **Security or ANX Subscribed TP premises equipment related incident is experienced by ANX Subscribed TP.**

During Class 4 troubles the ANXO participates by assisting the ANX CSP/ANX CEPO to respond to break-in incidents in an appropriate manner.

Class 5. **Other.**

Class 5 troubles concern all trouble not classified under Classes 1, 2, 3, and 4. These include troubles that affect ANX CSPs and ANX CEPOs, but are not ANX Subscribed TP affecting.

9.3 ANX Certification Assessment Requirements

For ANX Certification Assessment, ANX CSP and ANX CEPO Applicants will confirm that target values for the metrics identified in this section are in effect for their trouble handling procedures.

Once certified, the ANX CSPs and ANX CEPOs will monitor these metrics and submit reports listing measured values to the ANXO.

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[R9-1.: CertAss]   Trouble Handling Systems and Trouble Reporting/Trouble Report Acceptance

R ANX CSPs and ANX CEPOs **shall** operate trouble handling systems and **shall** confirm to the following trouble reporting/trouble report acceptance requirements that specifically relate to them:

1. ANX CSPs **shall** accept trouble reports related to ANX Subscribed TPs who are their customers. Further, ANX CSPs **shall** accept trouble reports from other ANX CSPs, from ANX CEPOs, or from the ANXO.

2. ANX CEPOs **shall** accept trouble reports from ANX CSPs or from the ANXO. ANX CEPOs **shall** report problems that indicate trouble in one or more ANX CSPs to those ANX CSPs that are direct customers of the ANX CEPO.

Measurement Technique:

R ANX CSP/ANX CEPO Applicants **shall** provide ANXO proof of operational trouble handling systems, and **shall** commit to comply with trouble reporting and trouble report acceptance requirements stated above, prior to ANX Certification Assessment.

[R9-2.: CertAss]   Trouble Help Desk Scheduled Service Time

The Trouble Help Desk Scheduled Service Time is the time that the Trouble Help Desk is planned to be offered. This parameter is measured in days per week and hours per day.

R ANX CSP/ANX CEPO **shall** commit that the Scheduled Service Time for the Trouble Help Desk **shall** be 24 hours per day, and 7 days per week by the time ANX Certification Assessment is completed. Trouble Help Desk services are operated by ANX CSPs for ANX Subscribed TPs to whom they provide ANX Network Service, and by ANX CEPOs for their ANX CSP customers. All metrics and requirements apply to services offered on behalf of ANX Subscribed TPs and ANX Traffic they exchange.

Measurement Technique:

R ANX CSP/ANX CEPO Applicants **shall** provide the date when they will activate their 24*7 Trouble Help Desk Scheduled Service Time before certification. The start date for the 24*7 service **shall** be prior to ANX Certification Assessment completion date.

[R9-3.: CertAss]   Trouble Help Desk Availability

Trouble Help Desk Availability is defined as the amount of time that the Trouble Help Desk is available via phone and not busy (busy is defined as a caller having to wait at least 2 minutes between menu selection and being connected to a real person (when the services of a real person

is requested)). The Availability is expressed as a percentage of the total scheduled time that includes outages and repairs.

R The Trouble Help Desk Availability **shall** be at least 99.95%, corresponding to a total unavailability of no more than 4.38 hours per year.

Measurement Technique:

R ANX CSP/ANX CEPO Applicants **shall** commit to comply with Trouble Help Desk Availability requirements stated above, prior to ANX Certification Assessment.

[R9-4.: CertAss] Trouble Help Desk Dispatch Delay for Customer Premises Service Problems

The Trouble Help Desk Dispatch Delay refers to the delay in dispatching repair or maintenance personnel to respond to customer premises based problems. The delay is measured between the time of establishment of the need for dispatch at the Trouble Help Desk and the arrival at the customer premises.

R The Trouble Help Desk Dispatch Delay **shall** be no more than 8 hours. Any postponement specifically requested, negotiated or caused by the customer to the Trouble Help Desk Dispatch time **shall** not be counted against the 8-hour Trouble Help Desk Dispatch Delay window.

Measurement Technique:

R ANX CSP/ANX CEPO Applicants **shall** commit to comply with Customer Premises Dispatch Delay Time requirements stated above, prior to ANX Certification Assessment.

[R9-5.: CertAss] Trouble Response Time

The initial Trouble Response Time is defined by the duration from receipt of the problem alert to the entry into a trouble ticket system documenting the action that was taken. The action can be to begin an internal investigation of the problem, or to refer to an appropriate entity for resolution.

R The Trouble Help Desk **shall** respond to troubles within the time specified in Table 9-1, depending on the trouble classification, and **shall** meet the requirements in Table 9-1.

Measurement Technique:

R ANX CSP/ANX CEPO Applicants **shall** commit to comply with Trouble Response Time requirements stated above, prior to ANX Certification Assessment.

Trouble Class	Response Time
Class 1	Customer call: ≤ 5 minutes average, 10 minutes maximum Service provider detected: ≤ 20 minutes maximum
Class 2	≤ 60 minutes 99% of time; average ≤ 20 minutes
Class 3	≤ 120 minutes 99% of time; average ≤ 60 minutes
Class 4	Not certified
Class 5	Not certified

Table 9-1: Trouble Response Requirements

[R9-6.: CertAss]   Trouble Escalation Policy

R   ANX CSPs and ANX CEPOs **shall** have an adequate Trouble Handling and Escalation Policy prior to ANX Certification.

Measurement Technique:

R   ANX CSP and ANX CEPO Applicants **shall** submit a written Trouble Handling and Escalation Policy prior to ANX Certification. The ANXO will verify the adequacy of this policy. An adequate policy **shall** at least contain the following:

1.   Responsibilities or titles of the staff in the escalation chain and general contact information at all levels involved **shall** be specified;

2.   Conditions for escalations **shall** be specified;

3.   The policy **shall** correlate the escalation level with the outage interval; and

4.   The policy regarding required vendor interactions (including vendor contact information or how this information is obtained) **shall** be correlated with the trouble escalation process of the service provider.

[R9-7.: CertAss]   Troubleshooting Metric

R   ANX CSPs/ANX CEPOs **shall** maintain capability to determine if a performance problem cited by an ANX Subscribed TP is within the ANX CSP/ANX CEPOs own network, the ANX Subscribed TP's enterprise network, or in the set of subsequent networks that form the path between the ANX Subscribed TP and another ANX Subscribed TP with which it communicates.

Measurement Technique:

R ANX CSP/ANX CEPO Applicants **shall** confirm to the ANXO that this requirement is met.

9.4 ANX Certification Verification Requirements

[R9-1.: CertVer]   Trouble Handling Systems and Trouble Reporting/Trouble Report Acceptance

R ANX CSPs and ANX CEPOs **shall** state quarterly to the ANXO that they operate trouble handling systems and confirm continuing compliance with the trouble reporting/trouble report acceptance requirements described for ANX Certification Assessment.

Measurement Technique:

R· ANX CSPs/ANX CEPOs **shall** provide ANXO proof of operational trouble handling systems, and **shall** state continuing compliance with the trouble reporting and trouble report acceptance requirements stated for ANX Certification Assessment.

[R9-2.: CertVer]   Trouble Help Desk Scheduled Service Time

R The Scheduled Service Time for the Trouble Help Desk **shall** be 24 hours per day, and 7 days per week.

Measurement Technique:

R ANX CSPs and ANX CEPOs **shall** state quarterly to the ANXO its Trouble Help Desk Scheduled Service Time.

[R9-3.: CertVer]   Trouble Help Desk Availability

R The Trouble Help Desk Availability **shall** be at least 99.95%, corresponding to a total unavailability of no more than 4.38 hours per year.

Measurement Technique:

R ANX CSPs and ANX CEPOs **shall** submit quarterly reports (monthly breakdowns) to the ANXO giving busy or no answer statistics on Trouble Help Desk Availability.

[R9-4.: CertVer]   Trouble Help Desk Dispatch Delay for Customer Premise Service Problems

R The Trouble Help Desk Dispatch Delay **shall** be no more than 8 hours. Any postponement specifically requested, negotiated or caused by the customer to the Trouble Help Desk Dispatch Time **shall** not be counted against the 8-hour Trouble Help Desk Dispatch Delay window.

Measurement Technique:

R ANX CSPs and ANX CEPOs **shall** submit quarterly reports (monthly breakdowns) to the ANXO giving statistics on customer premise dispatch times.

[R9-5.: CertVer]   Trouble Response Time

R The Trouble Help Desk **shall** respond to troubles within the time specified in Table 9-1, depending on the trouble classification, and **shall** meet the requirements stated in Table 9-1.

Measurement Technique:

R ANX CSPs and ANX CEPOs **shall** submit monthly reports to the ANXO giving average and standard deviation statistics on Trouble Response Time for all trouble classes.

[R9-6.: CertVer]   Trouble Escalation Policy

R ANX CSPs and ANX CEPOs **shall** follow the most recent Trouble Handling and Escalation Policy, determined adequate by the ANXO.

Measurement Technique:

R ANX CSPs and ANX CEPOs **shall** quarterly state ongoing compliance with the most recent Trouble Handling and Escalation Policy, determined adequate by the ANXO. ANX CSPs and ANX CEPOs **shall** submit in writing a new Trouble Handling and Escalation Policy whenever changes occur. The ANXO will verify the adequacy of this policy as defined for ANX Certification Assessment.

[R9-7.: CertVer]   Troubleshooting Metric

R ANX CSPs/ANX CEPOs **shall** maintain capability to determine if a performance problem cited by an ANX Subscribed TP is within the ANX CSP/ANX CEPOs own network, the ANX Subscribed TP's enterprise network, or in the set of subsequent networks that form the path between the ANX Subscribed TP and another ANX Subscribed TP with which it communicates.

Measurement Technique:

R ANX CSPs/ANX CEPOs **shall** confirm that they continue to comply with this requirement and **shall** present its troubleshooting policies to the ANXO quarterly. In the event that the ANX CSP/ANX CEPO fails to comply with this requirement, it **shall** report to the ANXO within 5 business days when this requirement is no longer met and for what reason. This includes failure to meet the requirement for a new ANX Subscribed TP, for any portion of the ANX CSP's ANX network, or for any subset of the ANX Subscribed TPs.

9.5 Summary of Trouble Handling Metrics Requirements

Table 9-2 summarizes requirements on Trouble Handling Metrics.

ANX Certification Assessment Requirements For Trouble Handling Metrics								
Section Number	Reference |Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
9-	1	Yes	Yes	Trouble Handling Systems and Trouble Reporting/Trouble Report Acceptance	Compliance	Yes	Quarterly	PDF
9-	2	Yes	Yes	Trouble Help Desk Scheduled Service Time	24 hours/day, 7 days/week	Yes	Quarterly	PDF / Excel (using template Q-THM.XLS)
9-	3	Yes	Yes	Trouble Help Desk Availability	≥ 99.95% (maximum of 4.38 hours of total outage per year)	Yes	Quarterly	PDF./ Excel (using template Q-THM.XLS)
9-	4	Yes	Yes	Dispatch delay to customer premises	≤ 8 hours	Yes	Quarterly	PDF / Excel (using template Q-THM.XLS)
9-	5	Yes	Yes	Trouble Response Time	See Table 9-1	Yes	Monthly	PDF / Excel (using template M-THM.XLS)
9-	6	Yes	Yes	Trouble Handling and Escalation Policy	Compliance	Yes	Quarterly or when changes occur	PDF
9-	7	Yes	Yes	Troubleshooting Metric	Compliance	Yes	Quarterly or when changes occur	PDF

Table 9-2: Trouble Handling Requirements Summary

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10. ANX CSP/ANX CEPO - ANXO Interfacing Requirements

10.1 ANX CSP/ANX CEPO - ANXO Connectivity

ANXO connects to the ANX Certified Exchange Point via 56 Kbps (or higher) dedicated access. Each ANX Certified Service Provider connects to the ANXO through a permanent virtual connection, e.g. via an ATM PVC at the primary ANX Certified Exchange Point. The ANXO also connects to each ANX CSP via a dial-up ISDN connection. This ISDN connection is initially used by the ANXO to conduct performance tests as part of the performance testing interfacing. Figure 10-1 illustrates the ANX CSP and ANX CEPO connectivity with the ANXO.
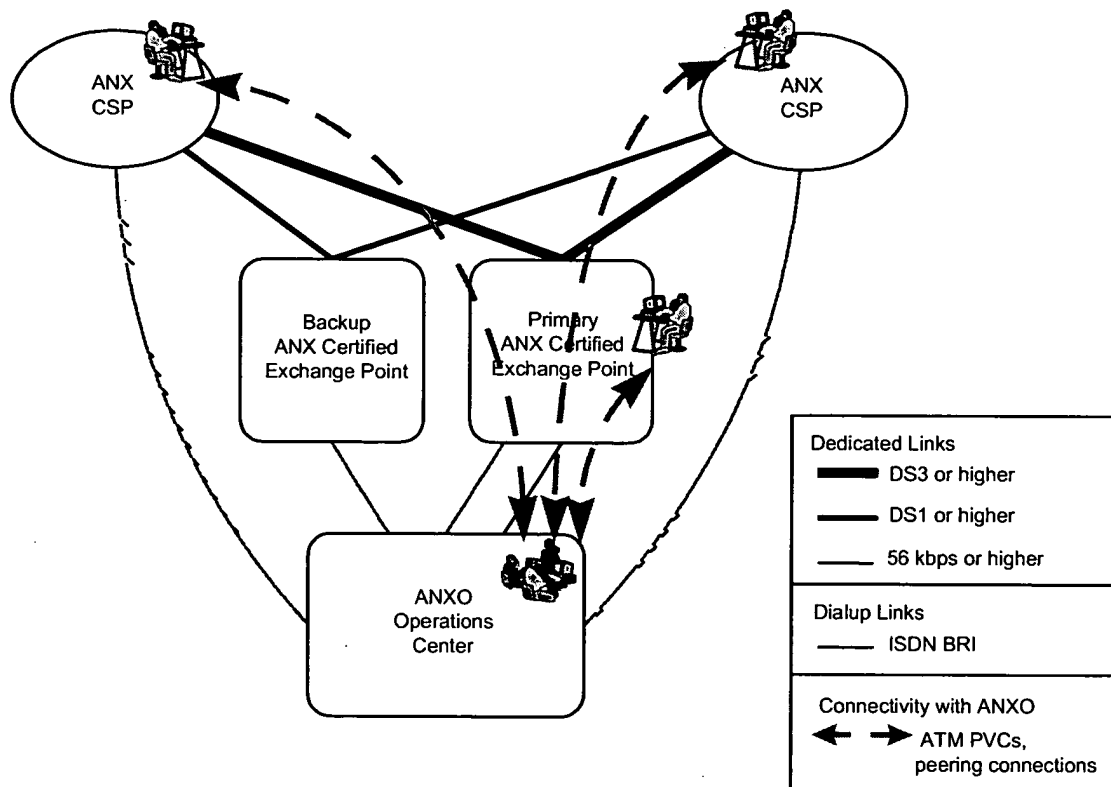
Figure 10-1: ANX CSP/ANX CEPO - ANXO Connectivity

10.1.1 ANX Certification Assessm nt Requir m nts

[R10-1.: CertAss]   Connectivity with ANXO

R   ANX CSP/ANX CEPO **shall** connect to the ANXO as demonstrated in Figure 10-1.

Measurement Technique:

This metric will only be assessed <u>after</u> the completed Third ANX Certification Assessment Report has been received by the ANX CSP/ANX CEPO Applicant stating that the ANX CSP/ANX CEPO Applicant has passed all metrics stated in that report.

R   ANX CSP/ANX CEPO Applicants **shall** successfully complete all connectivity configuration and testing with the ANXO in order to proceed with and establish all other necessary interfaces with the ANXO which are required for Certification.

10.1.2 ANX Certification Verification Requirements

[R10-1.: CertVer]   Connectivity with ANXO

R   ANX CSP/ANX CEPO **shall** maintain connectivity with ANXO at all times.

Measurement Technique:

R   ANX CSPs/ANX CEPOs **shall** quarterly provide a statement of compliance to the ANXO that connectivity continues to work.

10.1.3 Summary of ANX CSP/ANX CEPO-ANXO Connectivity Requirements

Table 10-1 provides the summary of ANX CSP/ANX CEPO-ANXO Connectivity requirements.

ANX Certification Requirements for ANX CSP/ANX CEPO-ANXO Connectivity								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
10-	1	Yes	Yes	Connectivity with ANXO	Compliance and Testing Completion	Yes	Quarterly	PDF

Table 10-1: Summary of ANX CSP/ANX CEPO-ANXO Connectivity Requirements

10.2 ANX CSP/ANX CEPO Data Collection and Reporting Interface with the ANXO

10.2.1 Background

This Part 2 document describes on the order of one hundred service metrics related to the following eight areas: (1) network service, (2) interoperability, (3) performance, (4) reliability, (5) business continuity and disaster recovery, (6) security, (7) customer care/help desk, and (8) trouble handling. There are significant testing, data collection and reporting requirements associated with both the initial ANX Certification Assessment process as well as with the ongoing ANX Certification Verification of ANX Certified providers. Both the ANXO and the ANX CSPs/ANX CEPOs will be responsible for performing tests of the metrics and for documentation of the network and various policies and procedures.

10.2.2 Common Procedures

10.2.2.1 Documentation

IP Service Providers (ISPs) and Exchange Point Operators (EPOs) which desire to become ANX Certified as providers of ANX Network Service must provide the ANX Overseer (ANXO) with comprehensive documentation about many aspects of their networks and operations as defined in the earlier sections of this document as part of the certification process.

After becoming certified, ANX Certified Service Providers (ANX CSPs) and ANX Certified Exchange Point Operators (ANX CEPOs) must continue to provide documentation to the ANXO to support the ANX Certification Verification process which assures ANX Subscribed TPs predictable service quality.

An ANX Certification Assessment/Verification Checklist which summarizes in a spreadsheet format all the metrics, corresponding measurement techniques and reporting formats to be used is made available to each service provider by the ANXO, and is posted at the ANX Network accessible ANXO web site. This spreadsheet must accompany each ANX Certification Assessment/Verification Reporting done by the ISP/EPO and ANX CSP/ANX CEPO.

10.2.2.2 Submission to ANXO

PDF files, text files, and Excel files should be sent on 3.5" floppy or Iomega-compatible zip drive to arrive on or prior to the specified delivery dates.. This applies to both ANX Certification Assessment and ANX Certification Verification data reporting.

10.2.3 ANX Certification Assessment Requirements

This document provides a thorough description of the data collection and reporting requirements for ANX Certification Assessment for ISPs/EPOs.

[R10-2.: CertAss]   Data Collection and Reporting Interface

R   Formatting and submission of ANX Certification Assessment information to the ANXO **shall** follow the same reporting requirements established for ANX Certification Verification, except that it is done one time, prior to ANX Certification Assessment, by the ISPs/EPOs who apply for ANX Certification process.

Measurement Technique:

R   ANX CSP/ANX CEPO Applicants **shall** provide ANX Certification Assessment data for all the metrics specified in this document to the ANXO, in compliance with all the reporting procedures, formats, reporting intervals provided for ANX Certification Verification and **shall** successfully complete all reporting testing with the ANXO in order to demonstrate full understanding of all metrics reporting requirements.

10.2.4 ANX Certification Verification Requirements

[R10-2.: CertVer]   Data Collection and Reporting Interface

R   ANX Certification Verification information **shall** be formatted by the ANX CSPs/ANX CEPOs and submitted to the ANXO in compliance with the following reporting period and format procedures:

1.   Reporting Format:

   a)   ANX CSP/ANX CEPO **shall** fill out and provide ANXO the ANX Certification Verification Checklist with each quarterly, monthly, and change report submitted, clearly indicating which files have been submitted for which metrics (See Measurement Technique requirement). The checklist **shall** include:

   i)   the Service Provider Identification and Contact information, and

   ii)   the submitted filenames/path names that contain the ANX Certification Assessment data for each metric in the Measurement column..

   b)   For metrics that belong to the same metrics category, ANX CSP/ANX CEPO Applicants **shall** submit ANX Certification Verification data within the same file, to the extent this is practical.

i) Multiple files per metrics category are allowed when the size of metrics data is extensive, or when the ANX CSPANX CEPO receives ANXO's approval.

ii) ANX CSP/ANX CEPO Applicants **shall** not submit metrics data that belong to multiple metrics categories (Sections) within the same file.

c) All reporting **shall** be in Adobe Page Description Format (PDF) unless specified otherwise. Reporting formats for the metrics subject to ANX certification in each metric category, are provided in the last columns of the corresponding Summary Tables in this document, and on the ANX Certification Verification Checklist (color-coded by magenta).

i) Excel spreadsheets Q-CCHDM.xls, M-THM.xls, Q-THM.xls, Q-TPLIST.xls provided at the ANX Network accessible ANX web site **shall** be used for specified metrics.

ii) text files **shall** be submitted in raw format (non-PDF) to allow ANXO use of scripts to extract and summarize select data (text files are the output of performance tests provided by the ANX performance measurement tool). To assure integrity of contents, non-PDF submissions may be secured with PGP signature.

iii) few contracts (only one in ANX Release 1) identified can be submitted as hardcopy, if not available in electronic form.

d) Each section of the report should clearly indicate whether there have been any changes in the material being included since the previous report (using revision marks, change bars, underlined or highlighted text, etc.)

i) Each quarterly report must include open issues with regard to any of the metrics, and issues closed since the previous quarterly report, especially those associated with a trouble resolution or probationary state.

2. Reporting Period:

a) ANX CSP/ANX CEPO **shall** provide ANXO a **quarterly report** which includes ANX Certification Verification data for all metrics enumerated in this document. Majority of the metrics require quarterly reporting.

b) A limited number of metrics need monthly reporting, or reporting whenever there is a change. ANX CSP/ANX CEPO **shall** provide **monthly reports, or change reports** for these metrics identified in the Summary Tables in this document, as well as in the ANX Certification Verification Checklist. Metrics that require monthly reporting, or reporting upon change are color coded in the ANX Certification Verification Checklist (yellow/gray).

c) ANX Certification Verification Period **shall** start the first of the month following Certification or fifteenth of the month when Certification is granted, whichever comes first. For example, if a service provider "A" gains ANX Certification at 1/5/CCYY, his ANX Certification Verification Period will start 1/15/CCYY; and if a service provider "B" gains ANX Certification at 1/25/CCYY, his ANX Certification Verification Period will start 2/1/CCYY. The first day of the ANX Certification Verification Period is when the ANX CSP/ANX CEPO **shall** be actively collecting ANX Certification Verification data to report to ANXO at the end of the reporting period (quarter, or month, or when a change occurs). Therefore, end of a quarterly reporting period will be 4/15/CCYY for service provider "A", and 5/1/CCYY for service provider "B". (The same logic applies to monthly reporting).

d) Quarterly and monthly reporting of the ANX Certification Verification data to the ANXO **shall** be 15 days later, by the 1st or 15th of the month, following the end of the ANX Certification Verification period whichever comes first (i.e., reporting date = end of ANX Certification Verification Period + 15). This is to allow service providers enough time to package all the data and report in the required format. Using the same example above, service provider "A" and "B" will be providing their first quarterly reports on 5/1/CCYY and 5/15/CCYY respectively. (The same logic applies to monthly reporting).

e) All ANX Certification Assessment and ANX Certification Verification data including PDF files, text files, and Excel files should be sent to the ANXO on 3.5" floppy or Iomega-compatible zip drive to arrive on or prior to the specified delivery dates.

f) Reporting when a change occurs **shall** be done within 1 business day for tripwire metrics, and within 5 business days for non-tripwire metrics (for only those metrics requiring reporting upon changes, i.e. gray-coded metrics in the ANX Certification Verification Checklist)

3. Additional conditions:

a) ANX CSP/ANX CEPO reporting **shall** always be done by a primary authoritative contact whose contact information is provided to the ANXO prior to ANX Certification. ANX CSP/ANX CEPO **shall** also identify to the ANXO a secondary authoritative contact, and **shall** update contact information whenever changes in contact information occur.

b) For policy, contract, plan type of metric submissions, ANX CSP/ANX CEPO can provide a "No Change" statement, if there have been no changes since the last quarter. However, for each annual (4th quarter) reporting, the ANX CSP/ANX CEPO reporting **shall** provide a full report on each metric regardless of whether a change occurred or not in the previous three quarters for such metrics.

Measurement Technique:

R   ANX CSP/ANX CEPO shall provide ANX Certification Verification data for all the metrics specified in this document to the ANXO, in compliance with all the reporting procedures, formats, reporting intervals provided above.

10.2.5 Summary of ANX CSP/ANX CEPO Data Collection and Reporting Interface Requirements

Table 10-2 provides a summary of the data collection and reporting interface requirements, for periodic reporting to the ANXO, to be carried out by the ISPs/EPOs who apply for ANX Certification Process, and by the ANX CSPs/ANX CEPOs as part of their ANX Certification Verification Process.

<table>
<tr><td colspan="9">ANX Certification Requirements for ANX CSP/ANX CEPO Data Collection and Reporting Interface</td></tr>
<tr>
<td>Section Number</td>
<td>Reference Number</td>
<td>ISP/ ANX CSP</td>
<td>EPO/ ANX CEPO</td>
<td>Metric / Requirement</td>
<td>Criterion</td>
<td>ANX Certification Assessment</td>
<td>ANX Certification Verification</td>
<td>Reporting Format Assessment/ Verification</td>
</tr>
<tr>
<td>10-</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
<td>Data Collection and Reporting Interface</td>
<td>Compliance and Testing Completion</td>
<td>Yes</td>
<td>Quarterly/ Monthly/ Upon Change, Annually</td>
<td>PDF (unless specified otherwise)</td>
</tr>
</table>

Table 10-2: Data Collection and Reporting Interface Requirements Summary

10.3 ANX Route Service Interface

10.3.1 Introduction and Scope

This section provides an overview and a detailed description of the procedure for ANX CSP participation in the ANX Route Service.

Functionally, ANX Route Service is comprised of two components: ANX Route Server (RS) and ANX Routing Registry (RR).
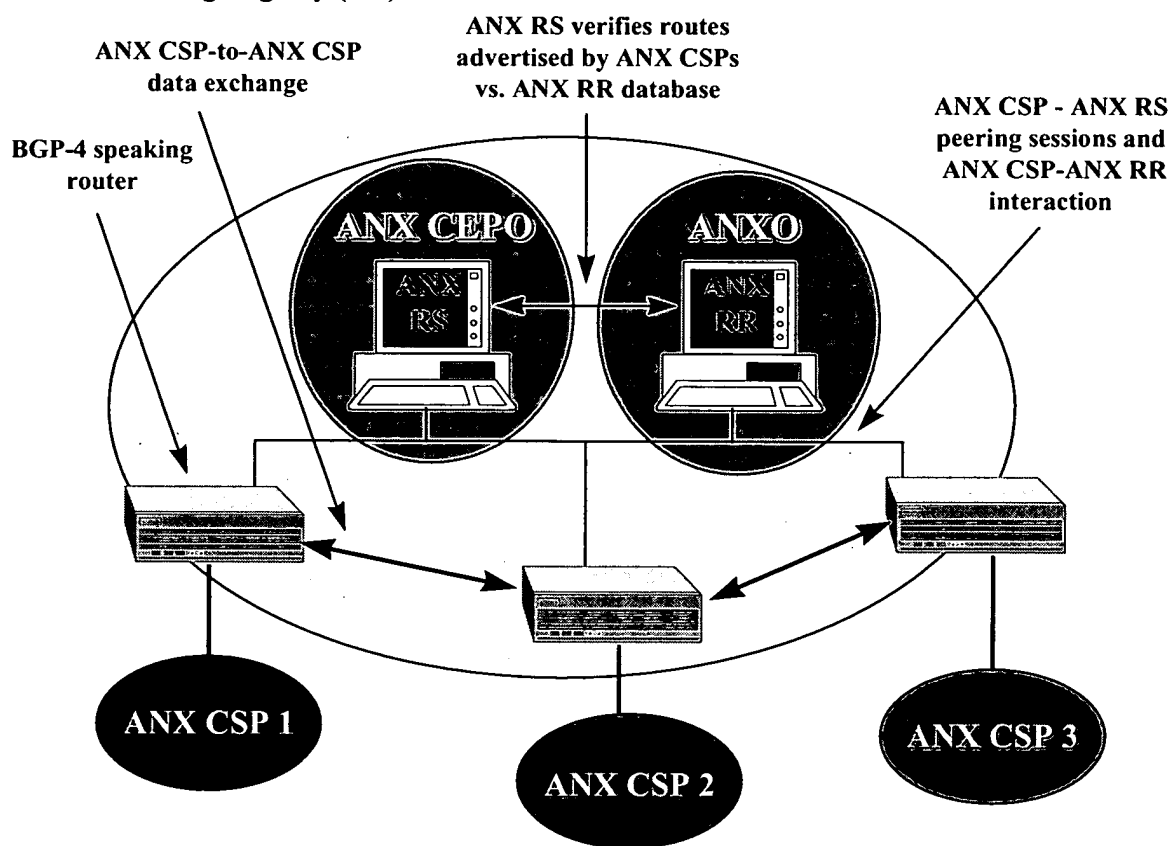
Figure 10-2: Functional Diagram of ANX Route Service

The ANX RS facilitates routing exchange among the ANX CSPs by gathering routing information from ANX CSP routers, processing the information based on the ANX CSP's routing policy requirements, and passing the processed routing information to each ANX CSP router.

In order for the ANX RS to peer (and exchange routing information) with an ANX CSP border router, the ANX CSP must register its inter-domain routing policy information in the ANX RR. Note that only routing policies that are compliant with all Certification Requirements for ANX CSPs (which are presented in [Part 6, Ref# 21]) are accepted and registered with the ANX RR. The ANX RR shares a similar format with the Internet RR, a virtual database currently comprising databases provided by the Routing Arbiter, RIPE, MCI, and CA*net. An overview of the IRR registries can be found in [Part 6, Ref# 24]. The ANX RR is a private, independent database and does not share information with the IRR. The ANX RS will derive a given ANX CSP's routing policy based on the information registered in the ANX RR.

10.3.1.1 ANX Route Service Subscription Process and Overview
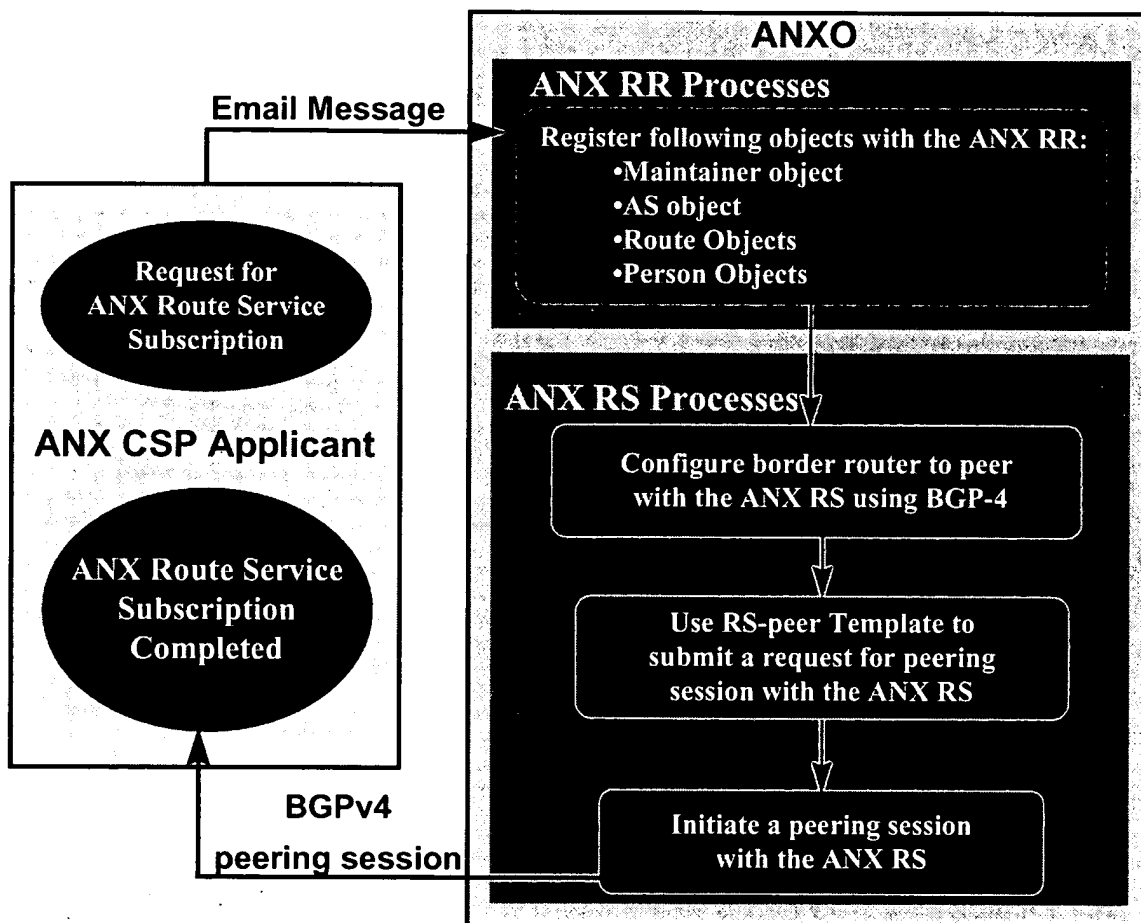
Figure 10-3: Overview of the ANX Route Service Subscription Process

All ANX CSPs are required to participate in the ANX Route Service. In order to participate in the ANX Route Service, ANX CSP must successfully complete the following processes:

1.   Register required objects with the ANX RR;

2.   Establish a peering session with the ANX RS.

These processes are described in detail in Sections 10.3.2 through 10.3.4 and in Section 3 of this document.

10.3.1.2 ANX CSP Subscription Withdrawal Process and Overview

ANX CSP can withdraw its subscription to the ANX Route Service by submitting a written request to the ANXO. The AS Subscription Withdrawal Template presented below must be completed and submitted to ANXO to initiate the ANX Route Service subscription withdrawal process. The AS Subscription Withdrawal Template must be completed and emailed to the address provided at the ANX Network accessible ANXO web site with the string "AS Unregister" included in the subject line of the message.

AS Subscription Withdrawal Template

------------------------------ CUT HERE -------------------------------------

AS Subscription Withdrawal Request

aut-num: The autonomous system number. This must be a uniquely allocated autonomous system number from an AS registry (i.e. the RIPE NCC, the Inter-NIC, etc.). Format: AS.

as-name: The name of the ANX CSP associated with this AS. This should be short but as informative as possible. Format: free text that must start with a capital letter.

TPs: List of all ANX Subscribed TPs to ANX Network Service provided by the ANX CSP, if any.

mnt-by: The mnt-by attribute contains a registered maintainer name. Refer to Maintainer Object Syntax for format and detailed explanation.

reason: Brief explanation of reason for subscription withdrawal.

changed: Specifies the individual requesting change/update followed by date of request. Format: email address CalenderYearMonthDay. Email address is in the format specified by RFC822 address. CalenderYearMonthDay specifies the date using 4 digit notation to indicate the calendar year, and 2 digit notation to indicate the month and day (i.e., ccyymmdd). Example changed attribute: dot@notes.bellcore.com 19970915

---------------------------- CUT HERE ------------------------------------

Upon receiving an AS Unregister request, ANXO staff will contact the contact persons identified by the mntner object(s) referenced by the request to verify the request. As soon as the "AS Unregister" request is verified, the following steps are completed by the ANXO staff:

1. AS objects and routes, registered and originated in the AS that requested the AS Unregister process, are removed from the ANX RR; ·

2. ANX RS closes all peering sessions with the border router(s) of the AS that requested the AS Unregister process;

3. ANX RS withdraws the routes, that were originated and advertised by the AS that requested the AS Unregister process.

10.3.1.3 ANX CSP Decertification

Only ANX CSPs are allowed to participate in the ANX Route Service. Thus, when an ANX CSP becomes decertified, that provider's subscription to the ANX Route Service is revoked and the following actions are taken by the ANXO staff:

1. AS objects and routes registered and originated in the AS of the decertified ANX CSP are removed from the ANX RR;

2. ANX RS closes all peering sessions with the border router(s) of the AS of the decertified ANX CSP;

3. ANX RS withdraws the routes that were originated and advertised by the AS of the decertified ANX CSP.

10.3.2 ANX Routing Registry

ANX CSPs provide routing information for all of their ANX Subscribed TPs to the ANXO via the ANX RR. ANX CSPs submit routing information query to the ANX RR via electronic mail.

The ANX RR shares a similar format with the Internet Routing Registry (IRR). Like IRR, the ANX RR database is based on the document RIPE-181 [Part 6, Ref# 21] and other supporting documents. RIPE-181 provides details of objects and attributes used within the ANX RR to store routing policies. RIPE-181 also includes a basic routing policy tutorial. RIPE-120 [Part 6, Ref# 22] specifies the syntax for authorization and notification of changes in the ANX RR using the RIPE database language.

Familiarity with RIPE-181 model and routing policy syntax is recommended but not necessary to effect registration in the ANX RR. This document details the steps and templates necessary to register in the ANX RR. The procedure described herein incorporates a brief overview of RIPE-181 syntax, including an explanation for registering four objects in the ANX RR:

1. Maintainer object, which specifies which individuals are allowed to perform updates to the given ANX CSP's ANX RR entries and how these individuals are authenticated;

2. Person object, which registers information about a contact person in the ANX RR and assigns a unique ANXO handle which can subsequently be used to uniquely identify that individual in the ANX RR;

3. Autonomous System (AS) object, which registers an AS and its routing policy;

4. Route object, which specifies a single route of an ANX Subscribed TP which is to be added to the ANX RR.

All ANX CSPs are required to register their Maintainer, AS and Route objects with the ANX RR.

10.3.2.1 ANX RR Registration Process and Overview

ANX CSPs interact with the ANX RR by submitting templates to register, update, delete and query objects in the ANX RR. The submitted templates are examined for the following:

1. syntax errors;

2. consistency of newly submitted information with objects registered in the ANX RR (e.g., no two providers are allowed to register the same AS number);

.3. authorization verification and authentication of requests, if appropriate.

Receipt of each ANX RR request is acknowledged by the ANXO staff. The acknowledgment message, indicating estimated time of completion of the request, is sent via email to the requester as well as to the individuals authorized to receive such information. If a request cannot be successfully processed, the originator of the request and the other authorized individuals receive a notification explaining the status of the request and recommending next steps, if appropriate.

If a request is successfully processed, confirmation is emailed to the requester of the process indicating the status of the process and the resulting ANX RR updates. A copy of the confirmation is emailed to the individual(s) authorized to receive updates regarding changes of appropriate objects in the ANX RR.
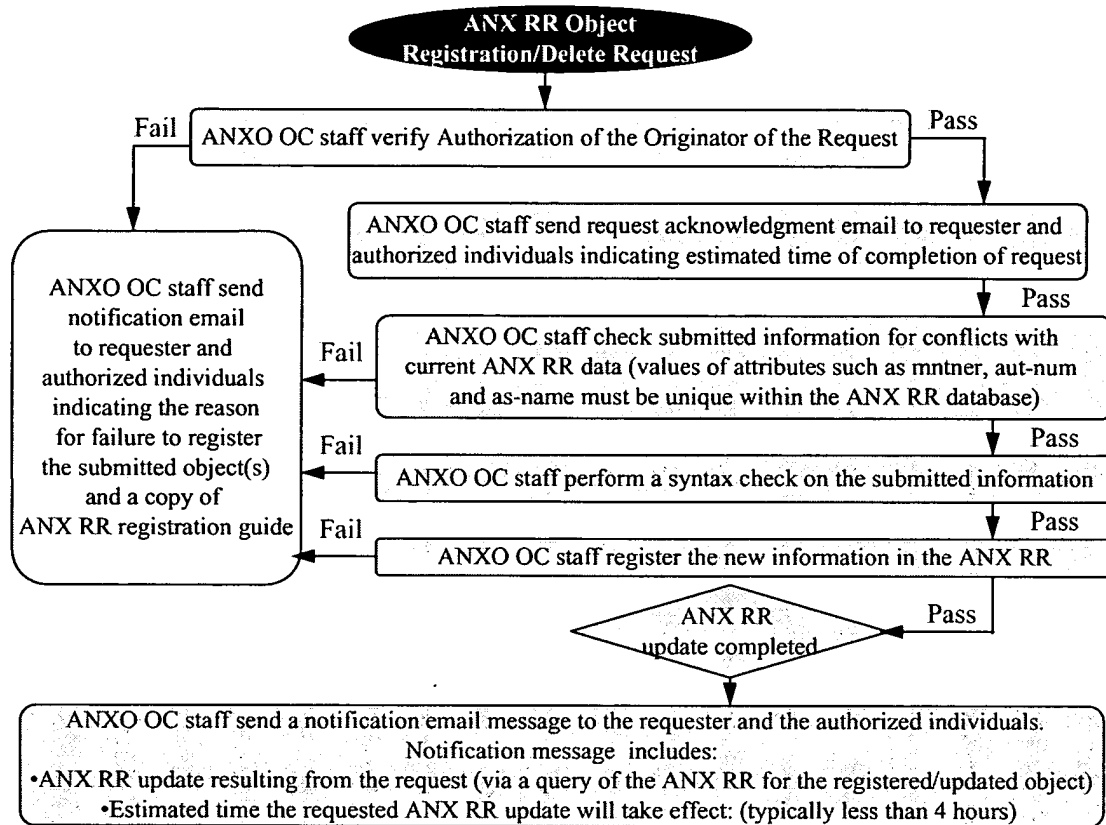
Figure 10-4: ANX RR Object Registration/Delete Process Overview

10.3.2.1.1 Maintainer Object Registration Process

The first step towards registering information in the ANX RR is to submit one or more Maintainer objects to the ANXO. Current version of the ANX RR allows for up to twenty-five (25) different Maintainer objects to be registered by an ANX CSP in the ANX RR.

The Maintainer object represents an entity or an individual maintaining objects in the ANX RR database.

Maintainer object is used to specify which individuals or entities are authorized to perform updates to a given ANX CSP's ANX RR entries and how these individuals are authenticated. Current version of the ANX RR supports authentication via a "mail from" attribute which indicates the email address(es) from which update requests are allowed. Maintainer object is identified and referred to by a unique maintainer name. The Maintainer object is used every time a database object with a "mnt-by" attribute is added, updated or deleted to determine whether the

originator of the update request is authorized to make the update. Thus, in order for a subsequent route or AS registration and/or update to be accepted by ANXO and registered in the ANX RR, a valid Maintainer object must be referenced. Thus, the names and electronic mail addresses of individuals who will be authorized to update AS and Route objects in the ANX RR need to be determined before an ANX CSP can register its Maintainer object(s).

10.3.2.1.1.1 Maintainer Object Syntax

Following is a list of Maintainer object attributes that must be submitted to the ANX RR to register a new Maintainer object or to update a pre-existing Maintainer object information:

mntner: Maintainer object name for an AS. Format: an upper case text string consisting of alphanumeric characters and "-" (dash) which is not the same as any maintainer name already defined.

descr: A short description of the maintainer entity. Format: free text.

admin-c: ANXO handle of an administrative contact person. This is the person with whom ANX RR-related coordination should be done. Format: ANXO assigned handle (also referred to as "nic-hdl") as described in "Person Object Registration Process" Section.

tech-c: ANXO handle for a technical contact person. This is someone to be contacted for technical problems such as bounced e-mail, etc. Format: ANXO assigned handle (also referred to as "nic-hdl") as described in "Person Object Registration Process" Section.

upd-to: Any unauthorized update request of an object maintained by this maintainer will be forwarded to this email address. Format: RFC-822 address.

mnt-nfy: Maintainer notification. This e-mail address will receive notification messages if any object maintained by this maintainer is added, changed or deleted. Format: RFC-822 address.

mnt-by: This attribute specifies who maintains this (Maintainer) object in the ANX RR database.

            Note that the admin-c attribute identifies the person or entity with whom ANX RR-related   coordination for a given object should be done. mnt-by attribute describes who is authorized   to effect changes in a given object and how the authorized person(s) are to be authenticated.

            The value of the mnt-by attribute is a reference to a mntner object in the database which describes those authorized to make changes to the object. Thus, the

maintainer object should contain a mnt-by attribute and its value should be the value of the mntner attribute. This self-reference specifies that updates to the maintainer object are allowed only from those email addresses specified in the maintainer object. Failure to register a maintainer object in this way would allow anyone to modify that maintainer and subsequently modify the objects it references.

auth: A mandatory attribute that specifies an email address from which changes are to be accepted. Multiple auth attributes are allowed per single mntner attribute. Format: MAIL-FROM RFC-822 address.

changed: Specifies the individual requesting change/update followed by date of request. Format: email address CalenderYearMonthDay. Email address is in the format specified by RFC822 address. CalenderYearMonthDay specifies the date using 4 digit notation to indicate the calendar year, , and 2 digit notation to indicate the month and day (i.e., ccyymmdd). Example changed attribute: dot@notes.bellcore.com 19970915 YearMonthDay. Email address is in the format specified by RFC822 address.

source: ANX

Note that the value of the source attribute shall always be "ANX," thus indicating that the object is registered in the private ANX RR database as opposed to the other IRR databases.

For a complete description and syntax of other optional attributes see [Part 6, Ref# 21] and [Part 6, Ref# 22].

10.3.2.1.1.2 Maintainer Object Template

To submit the Maintainer object information to the ANX RR, ANX CSPs must fill out the Maintainer Template presented below. If needed, ANX CSP can submit additional information to ANX RR by appending appropriate RIPE-120 compliant [Part 6, Ref# 22] fields to the Maintainer Template. Completed template must be emailed to the ANXO at the address provided at the ANX Network accessible ANXO web site with the string "RR - Maintainer Object" included in the subject line of the message.

Maintainer objects undergo a human check before being committed to the registry and therefore, as might be expected, turn-around time on registration of Maintainer objects is on the order of hours.

Maintainer Template

mntner:

descr:

admin-c:

tech-c:

upd-to:

mnt-nfy:

mnt-by:

auth:

changed:

source: ANX

Maintainer Template: Example

mntner:	MAINT-AS1234
descr:	Maintainer for AS1234
descr:	Maintainer for CSPA (AS1234)
admin-c:	John Doe
tech-c:	Bob Smith
upd-to:	bob@cspa.net
mnt-nfy:	bob@cspa.net
mnt-by:	MAINT-AS1234
auth:	MAIL-FROM bob@cspa.net
changed:	bob@cspa.net 19970929
source:	ANX

10.3.2.1.2 Person Object Registration Process

Person object is used to register a person's contact information with the ANX RR. As a result of Person object registration, the ANXO staff assigns a unique ANXO handle to a contact person. The ANXO handle can subsequently be used as a value of attributes of other objects within the ANX RR to uniquely identify a contact person. Unlike a full name, the ANXO handle also includes a company name and contact information.

10.3.2.1.2.1 Person Object Syntax

Following is a list of Person object attributes that must be submitted to the ANX RR to register a new Person object:

person:

address:

phone:

fax-no:

e-mail:

nic-hdl:

changed:

source: ANX

10.3.2.1.2.2 Person Object Template

person:	Full name of a contact person. Format: full name.
address:	Address information, including company name, street address, city, state, country and postal zip code. The address information may be provided as values of several address attributes. Format: free text.
phone:	Contact person's phone number. Multiple phone numbers must be presented as values of separate phone attributes. Format: area_code local_phone_number; the phone number must be expressed using digits; digits may be separated by blank spaces; the country dialing code, if present, must be preceded with "+." Example phone attribute: +41 24 345 6678
fax-no:	Contact person's facsimile number. Multiple facsimile numbers must be presented as values of separate fax-no attributes. Format: area_code local_phone_number; the phone number must be expressed using digits; digits may be separated by blank spaces; the country dialing code, if present, must be preceded with "+." Example fax-no attribute: +41 24 345 6678
e-mail:	Email address of the contact person. Format: RFC822 address format.
nic-hdl:	ANXO handle. This field should be left blank when registering a new Person object. ANXO handle will be allocated by the ANXO staff.
changed:	Specifies the individual requesting change/update followed by date of request. Format: email address CalenderYearMonthDay. Email address is in the format specified by RFC822 address. CalenderYearMonthDay specifies the date using 4 digit notation to indicate the calendar year, and 2 digit notation to indicate the month and day (i.e., ccyymmdd). Example changed attribute: dot@notes.bellcore.com 19970915
source:	ANX
	Note that the value of the source attribute shall always be "ANX," thus indicating that the object is registered in the ANX RR.

10.3.2.1.3 AS Obj ct Registration Proc ss

Once the Maintainer object is registered, the next step to participating in the ANX Route Service is to register an AS object. AS object specifies an AS and its routing policy. The requirement that all ANX CSPs shall peer with all the other ANX CSPs and exchange routing (reachability) information for all of their ANX Subscribed TPs is reflected by the ANX RR's "default" routing policy for all ANX CSPs. The default ANX RR policy implements the ANX Peering procedures [Part 6, Ref# 23] and states that an AS registered in the ANX RR must exchange all routes registered in the ANX RR with all the other registered ASs.

Should an ANX CSP desire to register a routing policy for its AS that is different from the ANX RR's default routing policy, the ANX CSP must submit such policy in the RIPE-181 format to ANXO. All requests for changes of ANX CSP routing policies shall be accompanied by the following information:

1.   an explanation of how such policy complies with the ANX Interoperability Certification Requirements for ANX CSPs; and

2.   justification of why such policy is necessary, including appropriate peering agreements.

10.3.2.1.3.1 AS Object Syntax

Following is a list of AS object attributes that must be submitted to the ANX RR to register a new ANX CSP AS number and routing policy:

aut-num:	The autonomous system number. This must be a uniquely allocated autonomous system number from an AS registry (i.e. the RIPE NCC, the Inter-NIC, etc.). Format: AS.
as-name:	The name of the ANX CSP associated with this AS. This should be short but as informative as possible. Format: free text that must start with a capital letter.
descr:	A short description of the Autonomous System. Format: free text.
admin-c:	ANXO handle for an administrative contact person. In many cases this would be the name of the guardian. Format: ANXO assigned handle (also referred to as "nic-hdl") as described in "Person Object Registration Process" Section.
tech-c:	ANX handle for a technical contact person. This is someone to be contacted for technical problems such as misconfiguration. Format: ANXO assigned handle (also referred to as "nic-hdl") as described in "Person Object Registration Process" Section.
remarks:	Remarks/comments, to be used only for clarification. Format: free text.

guardian: Mailbox of the guardian of the Autonomous system. Format: RFC822 domain format.

mnt-by: The mnt-by attribute contains a registered maintainer name. Refer to Maintainer Object Syntax for format and detailed explanation.

changed: Specifies the individual requesting change/update followed by date of request. Format: email address CalenderYearMonthDay. Email address is in the format specified by RFC822 address. CalenderYearMonthDay specifies the date using 4 digit notation to indicate the calendar year, and 2 digit notation to indicate the month and day (i.e., ccyymmdd). Example changed attribute: dot@notes.bellcore.com 19970915

source: ANX

Note that the value of the source attribute shall always be "ANX," thus indicating that the object is registered in the ANX RR.

For a complete description and syntax of optional attributes see [Part 6, Ref# 21] and [Part 6, Ref# 22].

10.3.2.1.3.2 AS Object Template

To submit the AS object information to the ANX RR, ANX CSPs must fill out the AS Template presented below. If needed, ANX CSP can submit additional information to the ANX RR by appending appropriate RIPE-compliant fields to the AS Template. Completed template must be emailed to the ANXO at the address provided at the ANX Network accessible ANXO web site with the string "RR - Update" included in the subject line of the message.

Initially, AS objects will undergo a human check before being committed to the registry and therefore, as might be expected, turnaround time on registration of AS objects will be on the order of hours. As the AS object submission process is fully automated, the turnaround time on registration of AS objects will be shortened to a matter of seconds.

AS Template

aut-num:

as-name:

descr:

admin-c:

tech-c:

remarks:

guardian:

mnt-by:

changed:

source: ANX

AS Template: Example

aut-num: AS1234

as-name: CSPA

descr: CSP Atlantic

admin-c: John Doe

tech-c: Bob Smith

remarks: CSP Atlantic; peering agreement version1

remarks: allenk@cspa.eng.net

guardian: allenk@cspa.eng.net

mnt-by: MAINT-AS1234

changed: bob@cspa.net 19971002

source: ANX

10.3.2.1.4 Route Object Registration Process

Once the Maintainer and AS objects are registered, ANX CSP may proceed with the registration of its ANX Subscribed TP routes. Route objects are used by ANX CSPs to register routing information for all of their ANX Subscribed TPs in the ANX RR.

10.3.2.1.4.1 Route Object Syntax

The Route object is used to represent a single ANX Subscribed TP route originated in to the ANX routing mesh.

Following is a list of Route object attributes that an ANX CSP must submit to ANX RR to register a single ANX Subscribed TP route:

route: The value of the route attribute is a classless address. It represents the exact route being injected into the ANX routing mesh. Format: route/mask length. Example route: 128.96.82.0/24. The representation of classless addresses is described in [Part 6, Ref# 21].

descr: A short description of the route. The value of this attribute must include the name of the ANX Subscribed TP that can be reached by this route (and relevant information); and as-name (see AS Object Syntax) of the ANX CSP providing ANX Network Service to the ANX Subscribed TP. ANX Subscribed TP and ANX CSP information may be provided as values of different descr attributes. Format: free text.

origin: The value of the origin attribute is an AS reference of the form AS1234 referring to the aut-num object of the ANX CSP which provides the ANX Network Service to the ANX Subscribed TP. It represents the AS injecting this route into the routing mesh. Format: AS.

remarks: Remarks/comments, to be used only for clarification. Format: free text.

mnt-by: The mnt-by attribute contains a registered maintainer name. Refer to Maintainer Object Syntax for format and detailed explanation.

changed: This attribute is used when a new route is registered or updated. Specifies the individual requesting change/update followed by date of request. Format: email address CalenderYearMonthDay. Email address is in the format specified by RFC822 address. CalenderYearMonthDay specifies the date using 4 digit notation to indicate the calendar year, and 2 digit notation to indicate the month and day (i.e., ccyymmdd). Example changed attribute: dot@notes.bellcore.com 19970915

withdrawn: This attribute is used when a registered route is withdrawn for aggregation purposes or to document a route withdrawal. Specifies the individual requesting withdrawal followed by date of request for withdrawal. Format: email address CalenderYearMonthDay. Email address is in the format specified by RFC822 address. CalenderYearMonthDay specifies the date using 4 digit notation to indicate the calendar year, and 2 digit notation to indicate the month and day (i.e., ccyymmdd). Example changed attribute: dot@notes.bellcore.com 19970915

source: ANX

Note that the value of the source attribute shall always be "ANX," thus indicating that the object is registered in the ANX RR.

For a complete description and syntax of optional attributes see [Part 6, Ref# 21] and [Part 6, Ref# 22].

10.3.2.1.4.2 Route Object Template

To submit the Route object information to the ANX RR, ANX CSPs must fill out the Route Template presented below. If multiple Route objects are submitted in a single email message, the individual Route objects must be separated by a blank line. ANX CSP may submit additional information to the ANX RR by appending appropriate RIPE-compliant fields to the Route Template. Completed Route Template must be emailed to the ANXO at the address provided at the ANX Network accessible ANXO web site with the string "RR - Update" included in the subject line of the message.

Initially, like the Maintainer and AS objects, Route objects will undergo a human check before being committed to the registry and therefore turnaround time on registration of Route objects will on the order of hours. As the AS and Route object submission process if fully automated, the turnaround time on registration of Route objects will be shortened to a matter of seconds.

Route Template

route:

descr:

origin:

remarks:

mnt-by:

changed:

withdrawn:

source: ANX

Route Template: Example

route:	128.96.94.0/24
descr:	TP1
descr:	CSPA
origin:	AS1234
remarks:	This route in managed by bobby@cspa.eng.com
mnt-by:	MAINT-AS1234
changed:	bob@cspa.net 19971002
source:	ANX

10.3.2.2 Querying ANX RR Database

Initially, ANX CSPs can query the ANX RR database by sending an email message to the address provided at the ANX Network accessible ANXO web site with string "RR-query" in the subject line of the message. The template of the RR-query email message is presented below. The template includes the syntax for several types of queries. Note that any one or multiple queries can be included in a single email message.

RR-query Template

AS[AS number]

[route using CIDR notation: w.x.y.z/mask]

mntner

RR-query Template: Example

AS2885

128.96.0.0/16

199.98.16.0/24

MAINT-AS1234

Once various security issues are resolved, ANX CSPs will be able to query the ANX RR database via a web-based interface.

10.3.2.3 Deleting Objects from the ANX RR

ANX CSPs may delete Maintainer, Route and AS objects from the ANX RR. To delete an object from the ANX RR, ANX CSP must resubmit the existing object as it appears in the ANX RR (including the value of the change attribute) with the following line appended to it:

delete: email address of authorized person in the RFC 822 address format <reason for deletion>

The request to delete an object from the ANX RR must be submitted via email to ANXO at to the address provided at the ANX Network accessible ANXO web site with the string "RR-Update" included in the subject line of the message. Note that the mnt-by attribute of the registered objects specifies the entity and a corresponding email address(es) authorized to delete the object from the ANX RR.

An exact copy of the existing object as it appears in the ANX RR can be obtained by submitting an ANX RR query of that object.

10.3.2.4 Updating Registered Objects in the ANX RR

ANX CSP may update objects registered in the ANX RR by following the following procedure:

1. Submit a request to the ANXO to delete the existing object(s) from the ANX RR, as described in the Section "Deleting Objects from the ANX RR" of this document;

2.   Re-submit corrected objects for registration in the ANX RR, as described in the Section "ANX RR Registration Process and Overview" of this document.

10.3.3 ANX CSP Procedure for Peering with ANX Route Server

The ANX RS is configured to peer with all the ANX CSPs registered in the ANX RR. After successfully submitting its administrative and routing information to the ANX RR, an ANX CSP can initiate a peering session with the ANX RS by configuring its border router to use BGP-4 to exchange routing information with the ANX RS.

Note that the syntax of BGP-4 router configuration varies by router vendors. ANX CSPs are responsible for configuring their border routers to peer with the ANX RS using BGP-4.

To notify the ANX RS that the ANX CSP is ready to peer or to change the ANX CSP border router information, ANX CSP should submit an email message to ANXO with the following information:

1.   ANX CSP's AS number

2.   IP address(s) of its border router(s).

ANX CSP should send the email message to the address provided at the ANX Network accessible ANXO web site with string "RS-peer" in the subject line of the message. The template for the RS-peer email message is presented below.

Note that the "aut-num" and "peer" attributes are used to initiate peering sessions with AS numbers and the ANX CSP border routers, respectively. The "aut-num-delete" and "peer-delete" attributes are used to close previously requested peering session(s) with a given AS number and/or ANX CSP peer router. Up to five (5) border routers of an ANX CSP can peer with the ANX RS. Hence, at any given time, no more than five different "peer" attributes can be registered in the ANX RR by an ANX CSP.

RS-peer Template

aut-num: AS[AS number]

aut-num-delete: AS[AS number]

peer: [IP address of ANX CSP's border router_1]

peer: [IP address of ANX CSP's border router_n]

peer-delete: [IP address of ANX CSP's border router_2]

10.3.4 ANX RR to ANX RS Interface

The ANXO is responsible for the operation of the ANX Routing Registry whereas the ANX CEPO is responsible for the operation of the ANX Route Server. A route configuration file is created by the ANX CEPO using the most recent data in the ANX RR, such as ANX CSP policies and routes to be advertised. A new configuration file is created at least every four hours. Upon creation of a new configuration file, the RSd process rereads the configuration file. This process ensures that the most up-to-date peer and ANX RR information is used on the ANX RS.

The ANX Routing Registry can either be queried remotely by the ANX CEPO or can be mirrored locally at the ANX CEPO site. If the ANX Routing Registry is mirrored, then ANXO will randomly access to the mirrored database for checking its accuracy and consistency with the ANX Routing Registry Database.

10.3.5 Questions and Inquiries

All questions and inquiries regarding the ANX RR and the ANX RS should be submitted to ANXO OC administrative staff at the e-mail address provided at the ANX Network accessible ANXO web site.

10.3.6 ANX Requirements for ANX Certification Assessment

[R10-3.: CertAss]   Participation in ANX Route Service

R ANX CEPOs **shall** produce an ANX Route Server configuration file from the ANX Routing Registry data at least every four hours and **shall** have RSd process reread the new configuration file. If the ANX CEPO operates a locally mirrored ANX RR, then the ANXO **shall** have access to the mirrored copy for checking accuracy and consistency with the ANX RR database at the ANXO OC.

R ANX CSPs **shall** comply with the all day-to-day processes and procedures of the ANX Route Server/Route Registry services, which are necessary to achieve reachability and correct routing to all ANX Subscribed TPs. ANX CSPs **shall** register required objects with the ANX RR and peer with the ANX RS.

Measurement Technique:

This metric will only be assessed <u>after</u> the completed Third ANX Certification Assessment Report has been received by the ANX CSP Applicant stating that the ANX CSP Applicant has passed all metrics stated in that report.

R ANX CEPO Applicants **shall** commit to refresh the ANX Route Server configuration file using information consistent with the ANX RR database located at the ANXO OC. ANX CEPO Applicants **shall** agree to allow ANXO access to all ANX Route Servers and their mirrored ANX RR database, if they implement a local replica.

R ANX CSP Applicants **shall** successfully complete all one-on-one processing, configuration, and testing with the ANXO in order to participate in the ANX Route Service in full compliance with all the processes described in this section prior to ANX Certification Assessment, including but not limited to the following:

1. Each ANX CSP Applicant **shall** register required maintainer, AS, person, and route objects with the ANX RR and utilize an inter-domain routing policy compliant with all Certification Requirements;

    a) Each ANX CSP Applicant **shall** submit route objects to the ANX RR, containing routing information for their ANX Subscribed TPs to whom they provide ANX Network Service,

    b) All IP addresses provided in the route objects for use by an ANX Subscribed TP **shall** conform to the addressing policies given by Classless Inter-Domain Routing (CIDR) as specified in RFCs 1517, 1518, 1519, and 1520.

2. Each ANX CSP Applicant **shall** submit, using the RS-peer template, a request for establishing a peering session with the ANX RS; and

3.   Each ANX CSP Applicant **shall** configure at least one of its border routers to peer with ANX RS using BGP-4 and initiate a peering session with the ANX RS upon being certified.

10.3.7 ANX Certification Verification Requirements

[R10-3: CertVer]   Participation in ANX Route Service

R   ANX CEPOs **shall** produce an ANX Route Server configuration file from the ANX Routing Registry data at least every four hours and **shall** have RSd process reread the new configuration file. If the ANX CEPO operates a locally mirrored ANX RR, then the ANXO **shall** have access to the mirrored copy for checking accuracy and consistency with the ANX RR database at the ANXO OC.

R   ANX CSPs **shall** participate in the ANX Route Service and **shall** comply with all day-to-day processes and procedures described in this section, which are necessary for continuity of ANX CSP's proper peering with the ANX Route Servers, achieving reachability and correct routing to all ANX Subscribed TPs, and ensuring its operational integrity on a continuous basis. ANX CSPs **shall** provide up-to-date routing information for all of their ANX Subscribed TPs to the ANXO via the ANX Routing Registry. All IP addresses provided in route objects **shall** conform to the addressing policies given by Classless Inter-Domain Routing (CIDR) as specified in RFCs 1517, 1518, 1519, and 1520.

Measurement Technique:

R   ANX CEPOs **shall** quarterly report its ongoing compliance with periodically refreshing the ANX Route Server configuration file using information consistent with the ANX RR database located at the ANXO OC and **shall** allow ANXO access to all ANX Route Servers and their mirrored ANX RR database, if they implement a local replica.

R   ANX CSPs **shall** quarterly report of its ongoing compliance and verify current correctness of all the objects it has registered in the ANX Routing Registry.

10.3.8 Summary of ANXO Route Service Interface Requirements

Table 10-3 provides the summary of ANX Route Service/ANX Route Registry Interface requirements.

ANX Certification Requirements for ANX Route Service Interface								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
10-	3	Yes	Yes	Participate in ANX RS/ANX RR interfacing with the ANXO	Compliance and Testing Completion	Yes	Quarterly	PDF

Table 10-3: Summary of ANX Route Service Interface Requirements

10.4 ANX Domain Name Service Interface

10.4.1 Introduction

The ANXO operates an ANX Domain Name Registry that contains every ANX Subscribed TP's domain name and name server IP addresses. Each ANX CSP operates an ANX-enabled DNS Server with a special configuration file for ANX Domain Name Service. This configuration file is made available by the ANXO to the ANX CSPs and optionally to ANX Subscribed TPs. The configuration file contains stub entries for each ANX Subscribed TP's domain, resulting in each DNS installing this configuration file to function as a secondary DNS to all ANX Subscribed TP's domain but with substantially less overhead then the secondary command.

10.4.2 ANX Domain Name Service Architecture

The ANX Domain Name Service is compatible and works with the Internet Domain Name Service. The ANX DNS uses the Internet root name servers to resolve names outside of the local domain for which the ANX DNS provides authoritative name resolution. To resolve hostnames, ANX Subscribed TPs use a DNS server either operated internally or use the DNS server that their ANX CSP operates. If an ANX Subscribed TP operates a DNS server internally, then ANX hostnames are resolved using normal Internet mechanisms. Each ANX Subscribed TP may also participate in operating an ANX-enabled DNS server by retrieving a special configuration file from the ANXO. Every ANX CSP operates at least one ANX-enabled DNS server with the special configuration file provided by the ANXO.

10.4.2.1 Basic ANX Domain Name Service

A basic ANX DNS can be set up by using existing Internet DNS servers. Administrators need to only add a subdomain to the existing ANX Subscribed TP domain. The ANX DNS communicates with the Internet root name servers to resolve external hostnames.

10.4.2.2 ANX-enabled Domain Name Service

Every ANX CSP operates an ANX-enabled DNS server that provides high availability name resolution. Each ANX Subscribed TP may also operate an ANX-enabled DNS server. The ANX-enabled DNS server does not rely on the Internet root name servers to resolve ANX Subscribed TP hostnames. This allows the ANX Network Service to continue to operate regardless of the availability of the Internet root name servers.

10.4.3 ANX C rtification Ass ssm nt R quirem nts

[R10-4.: CertAss] Participation in ANX-enabled Domain Name Service

R ANX CSPs **shall** participate in the ANX Domain Name Service and **shall** comply with all day-to-day processes and procedures described in this section, which are necessary in order to provide the most up to date domain name information to ANX Subscribed TPs. ANX CSPs **shall** retrieve the latest ANX DNS configuration file from the ANXO at least once per day using an automated procedure, and **shall** restart the name server to load the new configuration file. The ANX CSPs **shall** make at least one ANX-enabled DNS Server available to its ANX Subscribed TPs.

Measurement Technique:

This metric will only be assessed <u>after</u> the completed Third ANX Certification Assessment Report has been received by the ANX CSP Applicant stating that the ANX CSP Applicant has passed all metrics stated in that report.

R ANX CSP Applicants **shall** successfully complete all one-on-one processing, configuration, and testing with the ANXO in order to participate in the ANX Domain Name Service in full compliance with all the processes described in this section prior to ANX Certification Assessment, including but not limited to:

1.   Configuring at least one DNS server to participate with the ANXO as an ANX-enabled DNS Server; and

2.   Retrieving a configuration file from the ANXO using an automated procedure.

10.4.4 ANX Certification Verification Requirements

[R10-4.: CertVer] Participation in ANX-enabled Domain Name Service

R ANX CSPs **shall** participate in the ANX Domain Name Service and **shall** comply with all day-to-day processes and procedures described in this section, which are necessary in order to provide the most up to date domain name information to ANX Subscribed TPs. ANX CSPs **shall** retrieve the latest ANX DNS configuration file from the ANXO at least once per day using an automated procedure, and **shall** restart the name server to load the new configuration file. The ANX CSPs **shall** make at least one ANX-enabled DNS Server available to its ANX Subscribed TPs.

Measurement Technique:

R ANX CSPs **shall** quarterly provide a statement of compliance to the ANXO, regarding the operation, daily retrieval of the ANX DNS configuration file, and restart of an ANX-enabled DNS Server.

10.4.5 Summary of ANX Domain Name Servic Interfac Requir ments

Table 10-4 provides the summary of ANX Domain Name Service Interface requirements.

ANX Certification Requirements For ANX Domain Name Service Interface								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
10-	4	Yes	No	Participation in ANX-enabled Domain Name Service	Compliance	Yes	Quarterly	PDF

Table 10-4: Summary of ANX Domain Name Service Interface Requirements

10.5 ANXO Performance Testing Interface

10.5.1 Overview

The ANXO performance measurement tool will be used by the ANXO to monitor compliance with the performance metrics on access links between the ANX Subscribed TPs and ANX CSPs and over the ANXO-ANX CSP connections.

The ANXO performance measurement tool runs the fundamental performance tests of throughput, packet loss, and file transfer delay using the worst case acceptable methodology involving large file transfers. For all performance measurement tests, the ANXO performance tool operates under the classic client/server paradigm. The server resides at one network test point, the client resides at the other. The server merely performs passive opens of TCP connections on a well-known port. The functions of the server process are embodied by the TCP discard service located at the well-known TCP port equal to nine. The TCP discard service comes standard with most Unix implementations, including Free BSD.

The client process employs the services of a kernel TCP monitor/pseudo device driver that will be (along with a machine on which the client runs) supplied by the ANXO.

The ANXO-provided Test Points may be located at the ANXO OC, may be attached to the ANX CEP, and may be temporarily attached at the ANX Subscribed TP locations (outside the IPSec gateway/firewall). ANXO-provided Test Points will incorporate the functionality of both the client and the server processes of the ANXO performance measurement tool. The ANX CSP provided Test Points for the purposes of interfacing with the ANXO, on the other hand, will only need to include the functionality of the server process of the ANXO performance measurement tool (i.e. performing as Test Termination Points), for ANXO-run tests into the ANX CSP network.

10.5.2 Interface and Set-Up Requirements for Performance Tests

To participate in the ANXO-run performance tests, the ANX CSP will need to accommodate the following test scenarios:

1. Performance tests that will be run by the ANXO from a Test Point located within the ANXO OC or from a Test Point attached to the ANX CEP to a Test Termination Point located in the ANX CSP's network (over ANXO-ANX CSP connections, i.e. over a dial-up link or over the ANXO-ANX CSP connections through the ANX CEP, when connectivity is established).

2. Performance tests that will be run from a Test Point at an ANX Subscribed TP premises to a Test Termination Point located within the ANX CSP's network.

For all of these test scenarios, the Test Termination Point located within the ANX CSP's network will be required to perform passive opens of TCP connections initiated from a Test Point maintained by the ANXO. An ANXO Test Point may be located within the ANXO OC, or may be attached to the ANX CEP, or may be temporarily placed at an ANX Subscribed TP network (outside the IPSec gateway/firewall), on a well-known port (TCP discard service at TCP port 9) which comes standard with most UNIX implementations, including Free BSD. The ANX CSP Test Termination Point must also respond to ICMP messages for ping and traceroute in order for the ANXO Performance Test Tool to test connectivity and measure the number of IP hops prior to execution of performance tests. The ANX CSP will select and describe to the ANXO the location and IP address of the Test Termination Points according to the methodology described for the Test Termination Metric of the Performance Metrics Section of this document.

To participate in the ANXO performance tests, the ANX Subscribed TP will need to accommodate the following test scenarios:

1.   Performance tests that will be run from a Test Point located at the ANX Subscribed TP's network (outside the IPSec gateway/firewall) to a Test Termination Point located within the ANX CSP's network.

2.   The Test Point located at the ANX Subscribed TP's network will be supplied by the ANXO.

10.5.2.1 ANX CSP Requirements for Performance Tests from the ANXO OC to ANX CSP

Figure 10-5 outlines the ANX CSP requirements for participating in ANXO performance tests performed from a Test Point owned by the ANXO OC to a Test Termination Point located within the ANX CSP's network (either over a dial-up connection or ANXO-ANX CSP connection through the ANX CEP). Note that the ANXO Test Point may be located at the ANXO OC as illustrated in the figure, or may be attached to the ANX CEP. In addition to the requirements listed in Figure 10-5 and allowing ping and traceroute access as stated above, the ANX CSP will need to supply the following information to the ANXO OC staff for configuration of the ANXO Performance Tool:

1.   IP address of the Test Termination Point located at the edge of the ANX CSP's network;

2.   Address (including at least the city, state, and country) of the Test Termination Point located within the ANX CSP's network, or an estimate of the physical terrestrial surface distance (in kilometers) to Red Bank, NJ where the ANXO OC will be located.
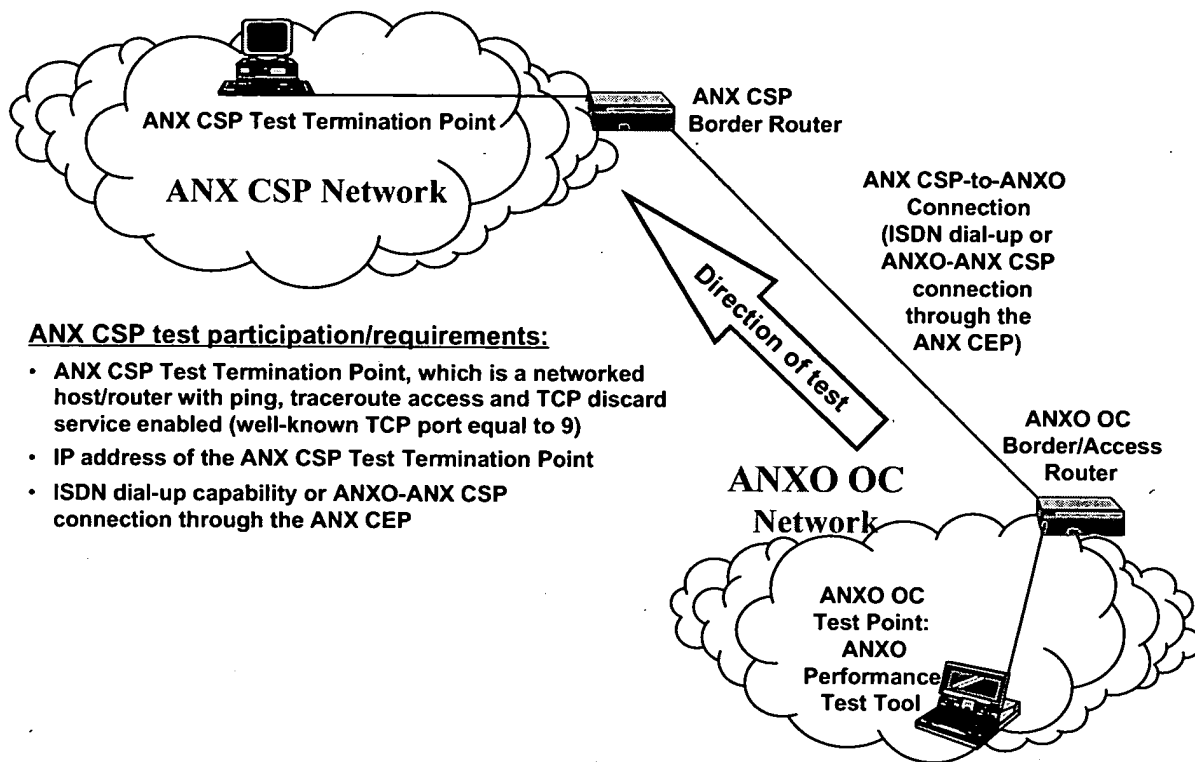
ANX CSP test participation/requirements:

- ANX CSP Test Termination Point, which is a networked host/router with ping, traceroute access and TCP discard service enabled (well-known TCP port equal to 9)
- IP address of the ANX CSP Test Termination Point
- ISDN dial-up capability or ANXO-ANX CSP connection through the ANX CEP

Figure 10-5: Diagram of Test Environment - ANXO OC to ANX CSP

10.5.2.2 ANX CSP and ANX Subscribed TP Requirements for Performance Tests from an ANX Subscribed TP Network to an ANX CSP Network

Figure 10-6 outlines the ANX CSP and the ANX Subscribed TP requirements for participating in the ANXO performance testing from a Test Point located within the ANX Subscribed TP network to a Test Termination Point located within the ANX CSP's network. The ANX CSP will need to supply the following information to the ANXO OC staff for configuration of the ANXO Performance Tool at the ANX Subscribed TP premises:
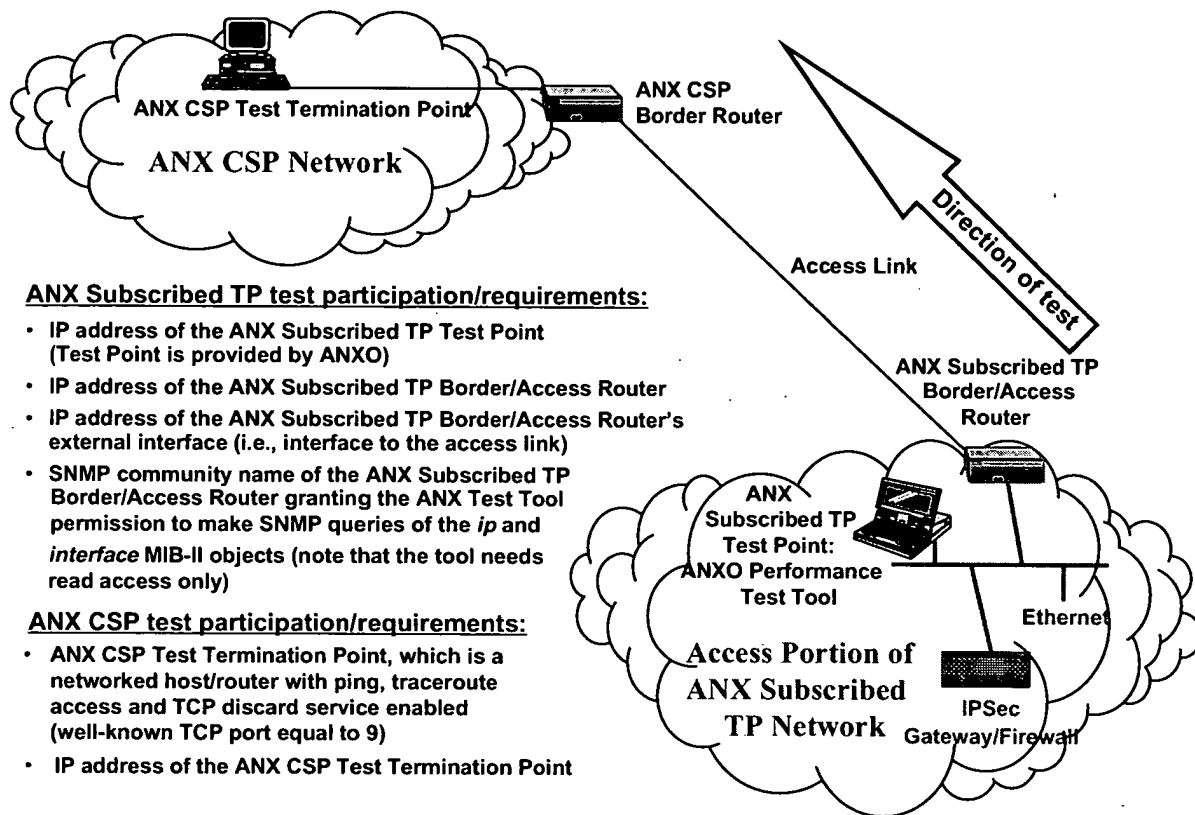
1. IP address of the Test Termination Point located within the ANX CSP's network;

2. Address (including at least the city, state, and country) of the Test Termination Point located within the ANX CSP's network, or an estimate of the physical terrestrial surface distance (in kilometers) to the access router of the ANX Subscribed TP from which the performance test is run.

To participate in the performance test, the ANX Subscribed TP will need to accommodate the Test Point supplied by the ANXO to attach to an IP subnet connected to its Border/Access router with the ANX CSP network as demonstrated in Figure 10-6 below. Note that this subnet should be outside the IPSec gateway/firewall of the ANX Subscribed TP. The Test Point interface to the ANX Subscribed TP's subnet connected to the border/access router is via 10Base-T Ethernet. In other words, the IP subnet to connect the Test Point should be an Ethernet network as shown in Figure 10-6. For non-disruptive attachment, an unused IP address and a spare RJ-45 port (10Base-T Ethernet port) to an existing hub must be available on the desired subnet. (Note that an AUI-to-RJ-45 converter can be used if the ANX Subscribed TP's Ethernet hubs only support AUI ports). Service for at least one machine will be disrupted if a spare Ethernet port or IP address is not available. To acquire a free RJ-45 port with minimal disruption, an attachment, preferably from a single host, to an existing hub should be disconnected and replaced with a connection to a small hub (e.g., a 4-port). The attachment from the old hub as well as from the Test Point should be connected to the small hub.

In addition, the ANX Subscribed TP will need to supply the ANXO OC staff with the following information to configure the ANXO Performance Tool located within the ANX Subscribed TP's network:

1. IP address and subnet mask assigned to the Test Tool connected to the ANX Subscribed TP's network;

2. IP address of the internal interface of the access router at the ANX Subscribed TP's premises;

3. IP address of the ANX CSP-facing interface of the access router at the ANX Subscribed TP's premises;

4. Data link layer technology of access router's interface to the ANX CSP;

5. SNMPv1 community name with read-only access to the ANX Subscribed TP's access router;

6. Address (including at least the city, state, and country) of the Test Point located within the ANX Subscribed TP's network.

Figure 10-6: Diagram of Test Environment - ANX Subscribed TP to ANX CSP

10.5.3 ANX CSP-to-ANXO OC Connectivity Requirements

To perform the initial performance testing interface with the ANXO OC, each ANX CSP will need to establish an ISDN dialup connection to the ANXO OC.

Upon connectivity to the ANX CEP, and establishing ANX Peering Connections with the ANXO, each new ANX CSP will allow ANXO to run performance tests through the ANXO-ANX CSP connections through the ANX CEP, or over ANX Subscribed TP access links, in addition to the dial-up link.

10.5.4 ANX Certification Assessment Requirements

[R10-5.: CertAss]   ANXO Performance Testing Interface

R   ANX CSPs **shall** participate in the ANXO performance testing by providing ANXO access to Test Termination Points within their networks, and necessary information (location of Test

Termination Points, IP addresses, SNMP community names, etc.), and **shall** get acquainted with the ANX performance testing tool as they themselves **shall** be running the same or similar tests within their networks on an ongoing basis.

Measurement Technique:

This metric will only be assessed <u>after</u> the completed Third ANX Certification Assessment Report has been received by the ANX CSP Applicant stating that the ANX CSP Applicant has passed all metrics stated in that report.

R ANX CSP Applicants **shall** successfully complete all one-on-one processing, configuration, and testing with the ANXO in order to enable ANXO-run performance tests, i.e., ANX CSP Applicants **shall** provide ANXO access to Test Termination Points within its network, and necessary information (location of Test Points, IP addresses, SNMP community names, etc.), as fully defined by the test scenarios described in this section and according to the methodology described by the Test Termination metric in the Performance Metrics Section of this document:

1. Performance tests that will be run from a Test Point located within the ANXO OC to a Test Termination Point located in the ANX CSP's network (over a dial-up link or over the ANXO-ANX CSP connections through the ANX CEP); and

2. Performance tests that will be run from a Test Point at an ANX Subscribed TP premises to a Test Termination Point located within the ANX CSP's network.

10.5.5 ANX Certification Verification Requirements

[R10-5.: CertVer]   ANXO Performance Testing Interface

R ANX CSPs **shall** provide ANXO 24*7 access to Test Termination Points within its network and the necessary information (location of Test Termination Points, IP addresses, SNMP community names, etc.) to enable ANXO-run performance tests, as fully defined by the test scenarios described in this section and according to the methodology described by the Test Termination metric in the Performance Metrics Section of this document.

Measurement Technique:

R ANX CSPs **shall** quarterly verify that they continue to maintain the same capability, and **shall** comply with ANXO requests if any changes in the location or connectivity characteristics of the test points are needed.

10.5.6 Summary of ANXO Performance Testing Interface Requirements

Table 10-5 provides the summary of Performance Testing Interface requirements.

ANX Certification Requirements for Performance Testing Interface								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
10-	5	Yes	No	ANXO Performance Testing Interface	Compliance and Testing Completion	Yes	Quarterly	PDF

Table 10-5: Summary of Performance Testing Interface Requirements

10.6 ANXO Trouble Handling Service Interface

10.6.1 Introduction

10.6.1.1 Purpose and Scope

This section describes the ANXO Trouble Handling service for resolving problems in the ANX Network. The assumption is being made that problems are resolved by ANX Participants to the extent this is possible. Problems in the ANX Network that can not be resolved should be escalated to the ANXO Help Desk through the ANXO Trouble Handling interface. The trouble resolution process can be initiated by ANX Subscribed TPs, ANX CSPs, ANX CEPOs, ANX CASPs and the ANXO Help Desk. The role of ANX CASPs with respect to problem resolution in the ANX Network is further explained in [Part 6, Ref #5].

10.6.1.2 Assumptions and Constraints

Assumptions used for the ANXO Trouble Handling service description include:

- Problems are resolved by ANX Participants to the extent this is possible. Only unresolved problems in the ANX Network should be escalated to the ANXO Help Desk.

- Problems are initially reported to the ANXO Help Desk via the ANXO Trouble Handling interfaces defined in this section (i.e., using the ANXO Trouble Handling Email interface or phone). During the trouble resolution process, information exchange with the ANXO Help Desk may take place via phone or fax.

10.6.1.3 ANXO Help Desk Contact Information

The ANXO Help Desk can be reached by phone, email, World Wide Web, or fax. The contact information can be obtained from the ANX Network accessible ANXO web site by the ANX Participants.
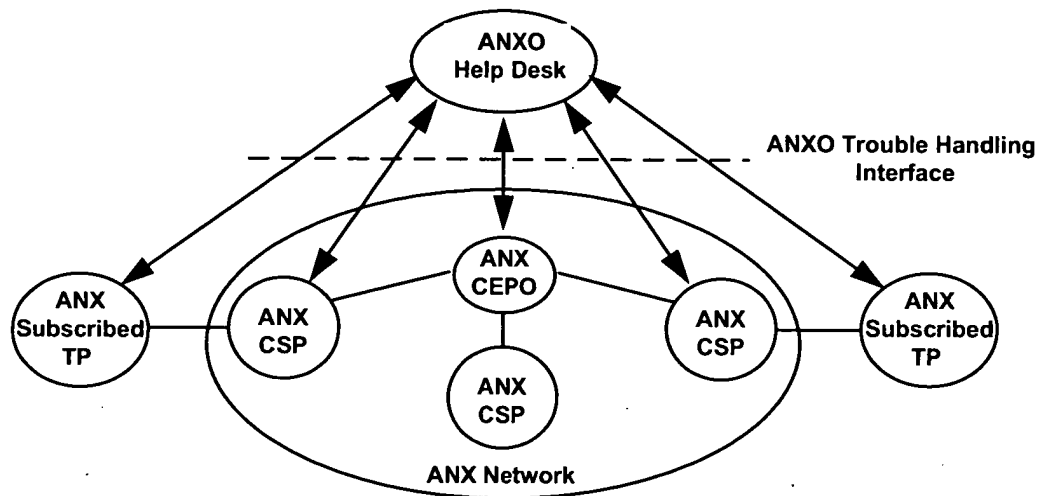
10.6.2 ANXO Trouble Handling Service Overview

This section provides an overview of the ANXO Trouble Handling service which includes:

1. The ANXO Trouble Handling service architecture;

2. The capabilities supported by the ANXO Trouble Handling service; and

3. The ANXO Trouble Handling service interface.

10.6.2.1 ANXO Trouble Handling Service Architecture

The core of the service architecture is presented by the ANXO Help Desk which is part of the ANXO Operations Center (OC). The ANXO Help Desk together with ANX Subscribed TPs are connected to the ANX Network which is made up of ANX CSPs and ANX CEPOs. Figure 10-7 illustrates the ANXO Trouble Handling service architecture.

Figure 10-7: ANXO Trouble Handling Service Architecture

10.6.2.2 ANXO Trouble Handling Service Capabilities

The following ANXO Trouble Handling service capabilities are provided to ANX Subscribed TPs, ANX CSPs, and ANX CEPOs:

1. Request ANX Network Service-related information such as ANX Registration and ANX Certification information, or an ANX CSP/ANX CEPO list.

2. Report escalated troubles which occurred in the ANX Network and could not be resolved.

3. Receive status update notifications of existing ANX Trouble Tickets during trouble resolution.

4. Retrieve information about existing ANX Trouble Tickets during trouble resolution (e.g., the status of an ANX Trouble Tickets).

5. Confirm closure of an existing ANX Trouble Tickets when the reported trouble is solved.

10.6.2.3 ANXO Trouble Handling Service Interfaces

Two access interfaces are supported for the first release of the ANXO Trouble Handling service. The first one is the phone (POTS) service supported by the regular telecom service providers. The second interface is Email which is described in detail in this document.

10.6.2.3.1 Phone

The ANXO Help Desk supports an Automatic Call Distributor (ACD) system for handling phone calls. This system is used for routing incoming phone calls to the appropriate support personnel in the ANXO OC.

10.6.2.3.2 Email

The ANXO Help Desk also supports an email server for support of an Email interface through which ANX Trouble Tickets can be exchanged with the ANXO Help Desk. The ANX Trouble Tickets Email template described in this document is used for exchanging ANX Trouble Tickets information via the Email interface.

10.6.3 ANX Trouble Escalation Model

The ANX Trouble Escalation model defines the procedural steps in the ANX problem resolution process [Part 6, Ref #1]. Two trouble resolution scenarios can be identified. In the first one, a trouble is detected by an ANX Subscribed TP and problem resolution initially takes places via exchange of trouble related information between the ANX Subscribed TP and ANX CSP to which the ANX Subscribed TP is connected. In the second ANX trouble resolution scenario, a trouble is detected either by an ANX Certified service provider (ANX CSP or ANX CEPO) in the ANX Network and initial trouble resolution takes place by exchange of trouble information between ANX CSPs and ANX CEPOs. Both scenarios are described in more detail in the remainder of this section.

10.6.3.1 TP-Initiated Trouble Resolution

Figure 10-8 illustrates the Trouble Escalation model for ANX Subscribed TP-detected troubles. Note that in this Trouble Escalation architecture, ANX Subscribed TPs, ANX CSPs, and ANX CEPO exchange escalated trouble information with the ANXO Help Desk using phone and Email via the ANXO Trouble Handling interface. The following steps can be identified in the ANX Subscribed TP-initiated trouble resolution process:

1. The ANX Subscribed TP determines if the detected trouble can be solved locally, in which case it is to be handled outside the scope of the ANX Network. If the trouble is related to the ANX CSP to which the ANX Subscribed TP is connected, and cannot be resolved within the ANX Subscribed TP network, resolution of the trouble is escalated to

the ANX CSP (arrow 1 Figure 10-8). It is expected that ANX Subscribed TPs will escalate detected problems to their ANX CSPs rather than directly to the ANXO as illustrated by arrows numbered 4 in Figure 10-8.

The ANX Subscribed TP and ANX CSP try to resolve the detected problem. The trouble resolution process typically consists of exchange of the trouble related information between the ANX CSP and the ANX Subscribed TP via phone and other communication means (e.g., email).

2. If resolution of the trouble involves other ANX CSPs/ANX CEPOs, the ANX CSP should coordinate the trouble resolution between the involved ANX CSP/ANX CEPOs, as indicated by the arrows numbered 2 in Figure 10-8.

3. In case the trouble can not be resolved by the ANX CSPs and ANX CEPOs involved in the trouble resolution process, the ANX CSP, to whom the ANX Subscribed TP who detected the trouble is connected, escalates the trouble to the ANXO Help Desk through the ANXO Trouble Handling interface. Each other ANX Subscribed TP, ANX CSP, and ANX CEPO involved in the trouble resolution process also submits an ANX Trouble Ticket to the ANXO Help Desk. If this information is not made available, the ANXO Help Desk requests that it be provided. This is indicated by the arrows numbered 3 in Figure 10-8.

    On receipt of the ANX Trouble Ticket, the ANXO Help Desk creates a new ANX Trouble Ticket and initiates the resolution process for resolving the detected trouble. During the trouble resolution process, the ANXO Help Desk communicates with the ANX CSPs and ANX CEPOs in the ANX Network. The ANX Participants involved in the trouble resolution process can track and are informed about the status of the ANX Trouble Tickets via the ANXO Trouble Handling interface.

4. The ANX Subscribed TP escalates troubles to the ANXO, only if the trouble escalation process defined in Step 1 above, does not work as illustrated by the dotted arrows numbered 4, Figure 10-8.
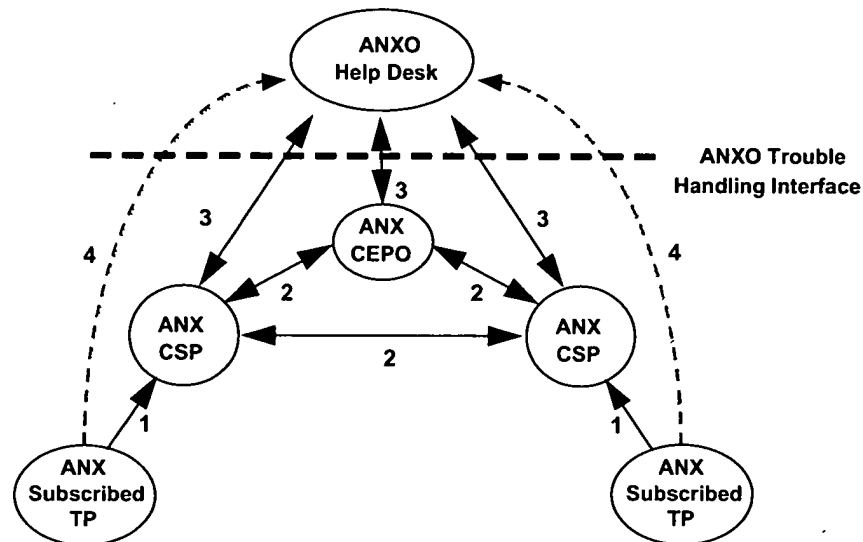
Figure 10-8: Trouble Escalation Model for ANX Subscribed TP-Initiated Trouble Tickets

10.6.3.2 ANX CSP/ANX CEPO-Initiated Trouble Resolution

Figure 10-9 illustrates the Trouble Escalation model for ANX CSP/ANX CEPO-detected troubles. In this trouble escalation architecture, ANX CSPs and ANX CEPO exchange information with each other to resolve problems and escalate trouble information to the ANXO Help Desk via the ANXO Trouble Handling interface.

The following steps can be identified in the ANX CSP/ANX CEPO-initiated trouble resolution process:

1. After detecting a trouble, the ANX CSP or ANX CEPO investigates whether other ANX CSPs and ANX CEPOs in the ANX Network are affected by the detected trouble (i.e., identify the scope of the trouble). If this is the case, the ANX CSP or ANX CEPO escalates the trouble to the effected ANX CSPs and ANX CEPOs, with the relevant data (as indicated by arrows numbered 2).

   The ANX CSP or ANX CEPO, together with the ANX CSPs and ANX CEPOs to which the trouble information was sent, shall try to resolve the problem. Note that this may imply that several ANX Trouble Tickets are exchanged among the ANX Participants.

2. If all the involved ANX CSPs/ ANX CEPOs cannot resolve the trouble, then the ANX CSP or ANX CEPO which initially detected the problem shall escalate an ANX Trouble Ticket to the ANXO Help Desk. Note that this ANX Trouble Ticket should contain a description of the problem and all the trouble history to date. Each other ANX CSP/ ANX CEPO involved in the trouble resolution process shall also submit an ANX Trouble

Ticket to the ANXO Help Desk. If this information is not made available, the ANXO shall request that it be provided. This follows arrows numbered 3 Figure 10-9.

3.   The ANXO shall initiate the ANXO Trouble Handling process for the trouble.
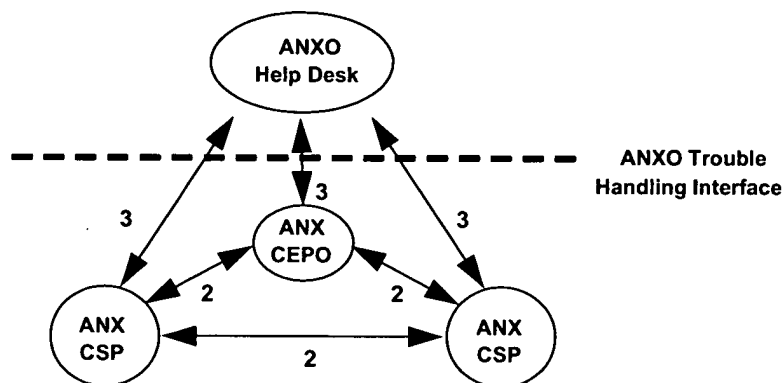
Figure 10-9: Trouble Escalation Model for ANX CSP/ANX CEPO-Initiated Trouble Tickets

10.6.4 ANXO Trouble Handling Service Subscription

After successful completion of the ANX Subscription process, ANX Participants can use the ANXO Trouble Handling service for resolving escalated problems that occurred in the ANX Network. Before ANX Participants can use the ANXO Trouble Handling service, they first have to subscribe to the service by providing information to the ANXO Help Desk. ANXO Trouble Handling service subscription forms are also made available as part of the ANX Registration Package to help eliminate ANXO Trouble Handling service subscription delays later on, especially at the occurrence of a trouble which may need quick escalation to the ANXO Help Desk.

The subscription process is as follows:

1.   ANX Participants must provide contact information to the ANXO Help Desk. This information must be provided to the ANXO Help Desk via Email using the ANXO Trouble Handling Service Email Template which can be obtained from the ANXO Help Desk or from the public ANXO web site.

2.   When ANXO Trouble Handling Service subscription information is received by the ANXO Help Desk, this information is incorporated in the ANXO Help Desk system and authentication and configuration information needed to access the ANXO Help Desk server is returned to the ANX Participant via Email.

3.   In addition to ANXO Help Desk related information, also an ANX Trouble Ticket Email template is provided by the ANXO Help Desk. This template must be used by ANX Participant when sending escalated trouble information to the ANXO Help Desk.

10.6.4.1 ANXO Help Desk Contact Information

On receipt of ANX Help Desk subscription information, the ANXO Help Desk personnel will make the required administrative updates in the ANXO Help Desk system. The last step of the ANXO Trouble Handling service subscription process is that the ANXO Help Desk returns an Email to the ANX Participant providing contact information needed for sending ANX Trouble Tickets to the ANXO Help Desk and authentication and configuration information for accessing the Remedy Trouble Ticketing system in the ANXO OC. The information that is sent to the ANX Participant is summarized in Table 10-6.

Field Name	Description
ANXO Help Desk Email Address	Address to be used for submitting ANX Trouble Tickets to the ANX Help Desk via email
ANXO Help Desk Server	Character string that indicates the ANX Help Desk server.
ANXO Help Desk Login ID	Textual string that needs to be included in the ANX Trouble Ticket for authentication purposes.
ANXO Help Desk Password	Textual string that needs to be included in the ANX Trouble Ticket for authentication purposes.
ANXO Help Desk Phone	Phone number of ANXO Help Desk.
ANXO Help Desk Fax	Fax number of ANXO Help Desk.

Table 10-6: ANXO Help Desk Contact Information

10.6.4.1.1 ANXO Help Desk Contact Email Template

Figure 10-10 provides the layout of the Email template used by the ANXO Help Desk for providing contact information to subscribers of the ANXO Trouble Handling service.

```
# ANXO Help Desk Contact Information
# ---------------------------------------------
# Date ........: 15 Oct, 1997
# Revision nr .: 1.0
# =============================================
```

```
# Please use the contact information below
# for submitting ANX Trouble Tickets to or
# contacting the ANXO Help Desk.

# ANXO Help Desk email address

<Email>

# ANXO Help Desk server name

<Server>

# ANXO Help Desk Login ID

<Login ID>

# ANXO Help Desk password

<Password>

# ANXO Help Desk phone number

<Phone number>

# ANXO Help Desk fax number

<Fax number>

# ==============================================
# End of ANXO Help Desk Contact Information
# ----------------------------------------------
```

Figure 10-10: Email Template for ANXO Help Desk Contact Information

10.6.4.2 ANX Trouble Report Email Template

During the subscription process of the ANXO Trouble Handling service, the ANXO Help Desk also provides an Email template which must be used for submitting ANX Trouble Tickets to the ANXO Help Desk. The email template is also posted on the public ANXO web site.

Table 10-7 summarizes the information fields that are included in the Email template. The detailed layout definition of the ANX Trouble Ticket Email template is defined in Section 10.6.4.2.5.

The first two fields (i.e., Server, and Login ID and Password) are related to ANXO Help Desk server and are provided during subscription to the ANXO Trouble Handling service.

The Action field indicates the requested operation indicated by the ANX Trouble Ticket. Table 10-8 summarizes the values that can be assigned to this field. All values listed in this table can be used by ANX Participants when submitting an ANX Trouble Ticket to the ANXO Help Desk.

Field Name	Description
Server	Character string that indicates the ANX Help Desk server.
Login ID Password	Textual string that needs to be in the ANX Trouble Ticket for authentication purposes. The login ID and Password are provided during subscription to ANX Trouble Handling service.
Action	Information specific for the Remedy AR System which indicates the requested operation. The values that can be assigned to this field are defined in Table 10-8.
Contact Name	Name of the person who submitted the ANX Trouble Ticket.
Contact Phone Contact Fax Contact Email	Contact information of ANX Trouble Ticket submitter. These fields are optional. If these fields are not used, the contact information provided during the subscription process of the ANXO Trouble Handling service will be used.
ANX Trouble Category	Information field indicating the problem category as defined in [Part 6, Ref #1]. See also Section 9.2.3.
Trouble Type	Enumerated field indicating the type of problem. **This field is for future use and will not be used during the first release of the ANXO Trouble Handling service.**
Short Description	Information field used to provide a short textual description of the problem or request.
Trouble History Information	Textual information about the historic events that occurred during resolution of the detected problem. See also Table 10-9.
Detailed Description	Textual information field that can be used for providing more detailed information about the reported problem.
ANX Participants	Other ANX Participants who are also involved in the resolution process of the detected problem.
Reference Trouble ID	Reference identification for the detected trouble that has been assigned by the initiator of the ANX Trouble Ticket.
ANX Trouble Ticket ID	Unique identification of ANX Trouble Ticket assigned by the ANXO Help Desk.
ANX Trouble Ticket Status	Field indicating the status of the ANX Trouble Ticket. The values of this field are defined in Table 10-10.
Creation Date	Date and time when the ANX Trouble Ticket was created.
Closure Date	Date and time when the ANX Trouble Ticket was closed.

Table 10-7: ANX Trouble Ticket Information

Contact information consists of the Name, Phone, Fax, and Email of the submitter of the ANX Trouble Ticket.

ANX Trouble Category, Trouble Type, Short Description, and Detailed Description fields indicate the nature of the detected problem.

The Trouble History Information field of the ANX Trouble Ticket provides information about historic events and operations to resolve the detected problem in the ANX network.

The ANX Participants field can be used by the submitter of the ANX Trouble Ticket to indicate other ANX Participants who are involved in the problem resolution process.

Finally, information to support unique identification of an ANX Trouble Ticket is provided by the ANX Trouble Ticket ID field and the Common Trouble ID field. Note that the latter field is optional and can be assigned by the submitter of the ANX Trouble Ticket.

10.6.4.2.1 ANX Trouble Ticket Action Types

The value of the Action field indicates the operation that is requested by the ANX Trouble Ticket. Currently, four types of operations are defined as shown in Table 10-8.

Action Field Value	Description
TR-Submit	Indicates that a new ANX Trouble Ticket is submitted to the ANXO Help Desk.
TR-Query	Indicates that a status update of an existing ANX Trouble Ticket is requested.
TR-Update	Indicates that an update of an existing ANX Trouble Ticket is requested.
TR-Close	Indicates that the status of the ANX Trouble Ticket should be changed to closed.

Table 10-8: ANX Trouble Report Action Types

10.6.4.2.2 ANX Trouble Categories

The values that can be assigned to the ANX Trouble Category field are defined in detail in Section 9.2.3. Note that the trouble severity classifications are defined from an ANX Subscribed TP point of view to sustain the ANX Subscribed TP-centric design of the trouble resolution process.

10.6.4.2.3 ANX Trouble History Record

Table 10-9 presents the format of these records. An ANX Trouble Ticket may include multiple history records.

Table 10-9: ANX Trouble History Record Format

Record Field	Description
Date and Time	Date and time indication when action to resolve the detected problem was performed. Format should be as follows: MM:DD:CCYY:HH:MM. For example, the time stamp for an action performed on September 3, at 1997 at 3.25PM should be written as 09:03:1997:15:25.
ANX ID	Identification of user that added the history information.
Description	Textual description of action to resolve the detected problem.

10.6.4.2.4 ANX Trouble Ticket States

Table 10-10: ANX Trouble Ticket States

State Value	Description
queued	ANX Trouble Ticket is queued to be processed.
open/active	ANX Trouble Ticket is opened and work is performed to resolve the indicated problem.
deferred	Work on the resolution of the problem indicated by the ANX Trouble Ticket is deferred.
cleared	Problem indicated by the ANX Trouble Ticket is solved and conformation is requested to close the ANX Trouble Ticket.
closed	Solution of the problem indicated by the ANX Trouble Ticket is finalized and confirmed, and the ANX Trouble Ticket is archived for administrative purposes.

10.6.4.2.5 Detailed Layout D finition of the ANX Troubl Ticket Email T mplate

Table 10-11 provides a more detailed definition of the information fields that are defined for the ANX Trouble Ticket template. Note that not that all information fields always need to be contained in the ANX Trouble Ticket Email message. Which fields are required when sending an Email to the ANXO Help Desk depends on the requested action as indicated in Table 10-11.

ANX Trouble Ticket Email Fields			Fields values based on TR Action Field Value			
Field ID	**Field Name**	**Remarks**	**TR-Submit**	**TR-Query**	**TR-Update**	**TR-Close**
2000000001	Login ID	See Note 1	Required	Required	Required	Required
2000000002	Password	See Note 1	Required	Required	Required	Required
2000000003	Requested Action	See Table 10-8	Required	Required	Required	Required
2000000004	Contact name	-	Optional[5]	-	-	-
2000000005	Phone	-	Optional[5]	-	-	-
2000000006	Fax	-	Optional[5]	-	-	-
2000000007	Trouble Category	See Section 9.2.3	Required	-	-	-
2000000009	Short Description	-	Required	-	-	-
2000000010	Trouble History Information	See Table 10-9	Optional	-	Optional[6]	-
2000000011	Detailed Description	-	Optional	-	Optional[6]	-
2000000012	ANX Participants	See Note 4	Optional	-	Optional[6]	-
2000000013	Reference ID	See Note 3	Optional	-	-	-
2000000014	ANX Trouble Ticket ID	See Note 2	-	Required	-	Required
2000000015	Creation Date	See Note 2	-	-	-	-
2000000016	Closure Date	See Note 2	-	-	-	-

Note 1: Value provided by ANXO Help Desk during subscription to ANXO Trouble Handling service.
Note 2: Value generated by the ANXO Help Desk system during creation of ANX Trouble Ticket.
Note 3: Value is optional and can be assigned by submitter of ANX Trouble Ticket.
Note 4: Value should be used to indicate all ANX Participants who are involved in trouble resolution process.
Note 5: The system will use a default value in case no value is provided.
Note 6: A value for at least one of the fields need to be provided.

Table 10-11: ANX Trouble Ticket Information Detail

10.6.4.2.6 ANX Troubl Ticket Email Template

An example layout containing all fields of the ANX Help Desk Email format is illustrated Figure 10-11. Note that which fields need to be included in the Email message depends on what action is requested (e.g., submittal or query of an ANX Trouble Ticket).

The following formatting rules need to be taken into consideration for the ANX Trouble Ticket Email format:

1. Lines starting with the "#" character are comments and are optional.

2. Lines that contain numbers like !2000000012! are processed by the Remedy AR server and only the area after the ":" character can be altered. (Note that the number indicates a field number). For example, in the line: "Password .....!2000000002!: <Password>" only the part after ":" can be altered which implies replacing "<Password>" in this case. Note that the leading characters before the field number are optional. So, the line mentioned above can also be written as follows: "!2000000002!: <Password>".

3. Information after the field number may span multiple lines. For example, the following line is valid:

```
Short description ....!2000000009!:  Short description of a
reported problem that spans more than one line.
```

Note that the following line is also valid:

```
Short description ....!2000000009!:
Short description of a reported problem that starts at a new line.
```

```
# ========================================================
# ANX Trouble Ticket Email template, Revision 2.0
# ========================================================

# --------------------------------------------------------
# General ANXO Help desk subscription parameters.
# --------------------------------------------------------

Help desk login ....!2000000001!: <LOGIN>
Help desk password .!2000000002!: <PASSWORD>

# --------------------------------------------------------
# Requested operation: TR-Submit, TR-Update, TR-Query,
# and TR-Close
# --------------------------------------------------------

Requested action .!2000000003!: <TR-ACTION>

# --------------------------------------------------------
# Contact Information. This is information is optional.
# If not needed, just ignore or delete the lines below.
# --------------------------------------------------------
```

```
Contact name .!2000000004!: <Contact name>
Phone ........!2000000005!: <Phone number>
Fax ..........!2000000006!: <Fax number>


# ---------------------------------------------------------
# Trouble Information: this information is only needed
# when submitting a new ANX Trouble Ticket (i.e., Action
# Field is equal to TR-Submit). If not needed, just
# ignore or delete the lines below.
# ---------------------------------------------------

Trouble Category ..!2000000007!: <Class Number>
Short description .!2000000009!: <Short description>
Trouble history ...!2000000010!: <History information>


# ---------------------------------------------------
# Trouble Information: this information is optional
# and only needed when submitting a new ANX Trouble Ticket
# (i.e., Action Field is equal to TR-Submit). If not
# needed, just ignore or delete the lines below.
# ---------------------------------------------------

Detailed description .!2000000011!: <Long description>
ANX Participants ..........!2000000012!: <ANX Participants>
Initiator TR ID ......!2000000013!: <Initiator TR ID>


# ---------------------------------------------------
# ANX Trouble Ticket ID: this information is only
# needed when a status update of an existing ANX Trouble
# Ticket is requested (i.e., Action Field is equal to
# TR-Query). If not needed, just delete or ignore the
# line below.
# ---------------------------------------------------

ANX Trouble Ticket ID .!2000000014!: <ANX TR ID>

# General ANX Trouble Ticket information
# ---------------------------------------------------

Creation Date..........!2000000015!: <Creation Date>
Closure Date ..........!2000000016!: <Closure Date>


# ===================================================
# End of ANX Trouble Ticket Email template
# ===================================================
```

Figure 10-11: Email Template for ANX Trouble Ticket Information


10.6.5 ANX Trouble Handling Process Flow

To conclude the ANXO Trouble Handling service description, the process flow of trouble resolution together with trouble escalation levels in the ANX Network is presented. Several trouble escalation levels are identified in the trouble handling process in the ANX Network. The transition from one level to the other phase implies escalation of a problem. The highest trouble escalation implies involvement of the ANXO Help Desk. The assumption is being made that only a few number of unresolved problems will be escalated to the ANXO Help Desk and that most problems problem can be resolved locally in the ANX Network. The trouble handling process in the ANX Network is described as follows:

1.   A trouble is detected either by an ANX Subscribed TP, ANX CSP, or ANX CEPO and the related ANX Participants in the ANX Network is notified. Section 10.6.5.1 describes a scenario in which a trouble is detected by an ANX Subscribed TP.

2.   In the next phase actions are initiated to resolve the detected trouble. ANX Subscribed TPs, ANX CSPs, and ANX CEPOs can be involved in this process. An ANX Subscribed TP exchanging information with an ANX CSP to resolve a problem is described in Section 10.6.5.2.

3.   Section 10.6.5.3 describes the next phase in the trouble resolution process. This phase is entered when problems can not be solved locally and multiple ANX Participants must be involved to resolve the detected problem in the ANX network.

4.   In the final phase of the trouble resolution process, the detected trouble can not be resolved by the ANX Participants and is escalated to the ANXO Help Desk. Section 10.6.5.4 describes the trouble resolution process in which the ANXO Help Desk communicates with the ANX Subscribed TPs, ANX CSPs, and ANX CEPO to coordinate trouble resolution in the ANX Network.

### 10.6.5.1 ANX Trouble Detection

A trouble in the ANX Network can be detected by either an ANX Subscribed TP, ANX CSP, or ANX CEPO. Figure 10-12 illustrates the detection of a problem by an ANX Subscribed TP. In this case, there is no connectivity between two ANX Subscribed TPs and the local Help Desk is involved to resolve the problem. When the ANX Subscribed TP's Help Desk personnel determines that the detected trouble can not be solved locally, the trouble is escalated to the ANX CSP's Help Desk and the next escalation phase of the ANX trouble resolution process is entered.
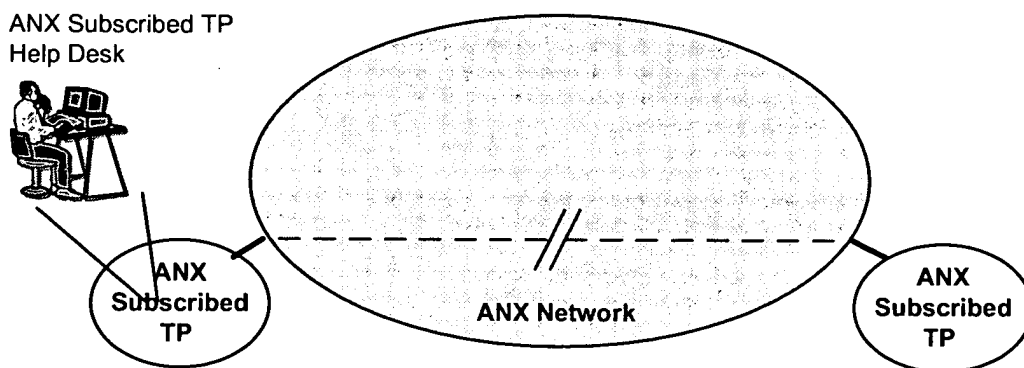
Figure 10-12: Detection of a Problem by an ANX Subscribed TP

10.6.5.2 Trouble Resolution by ANX Subscribed TPs and ANX CSPs

In the next escalation phase of the ANX trouble resolution process, ANX Subscribed TPs, ANX CSPs, and ANX CEPO try to solve the escalated problem locally. An example of such scenario is illustrated in Figure 10-13. The Help Desks of the ANX Subscribed TP and ANX CSP exchange information via phone and other communication means (e.g., Email) to resolve the escalated problem. Note that in this phase only a few ANX Participants are involved in the trouble resolution process and the assumption is being made that most problems can be resolved in this phase.
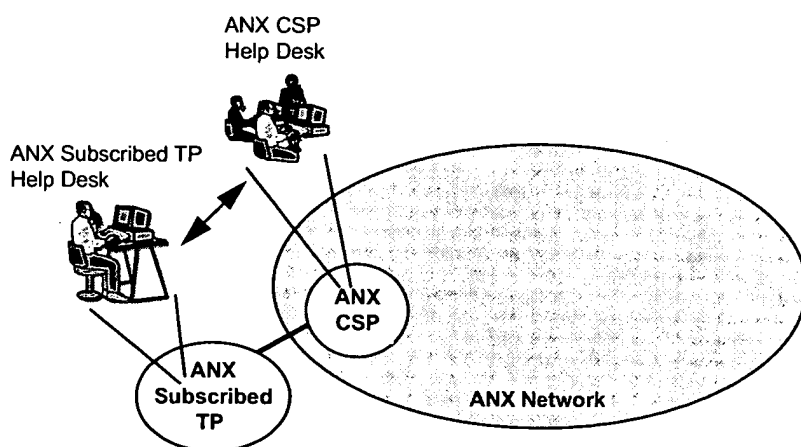
Figure 10-13: Trouble Resolution Process by ANX Subscribed TP and 'ANX CSP

### 10.6.5.3 Trouble Resolution by ANX Subscribed TP, ANX CSP, and ANX CEPO

In case the escalated problem in the ANX Network is from a more global nature and several ANX CSPs and, possibly, multiple ANX CEPOs needs to get involved in the trouble resolution process, the third escalation level is entered. In this phase, coordination must take between the ANX CSPs and ANX CEPOs to resolve the problem in the ANX Network. Figure 10-14 illustrates a third escalation phase scenario in which Help Desk personnel of an ANX Subscribed TP, ANX CSP and ANX CEPO exchange information to resolve a detected problem.
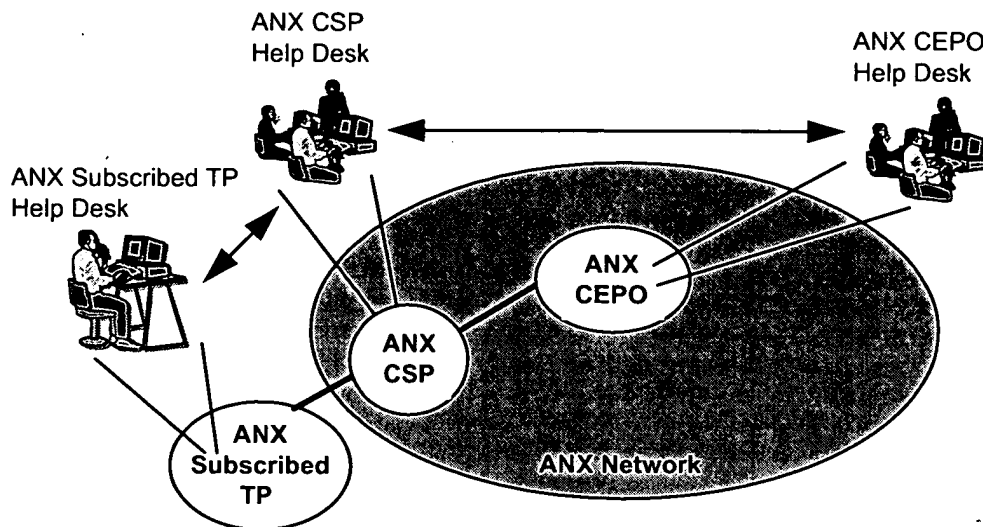
Figure 10-14: Trouble Resolution Process by ANX Subscribed TP, ANX CSP, and ANXO CEPO

10.6.5.4 Trouble Resolution by ANXO Help Desk

In case the trouble can not be resolved by the ANX Subscribed TPs, ANX CSPs, and ANX CEPOs involved in the trouble resolution process, the next escalation phase is entered in which the trouble is forwarded to the ANXO Help Desk through the ANXO Trouble Handling interface. Each ANX Participant involved in the trouble resolution process should submit an ANX Trouble Ticket to the ANXO Help Desk. If this information is not made available, the ANXO Help Desk will contact the corresponding ANX Participant(s) to request this information. On receipt of an ANX Trouble Ticket, the ANXO Help Desk updates its Help Desk system and initiates the resolution process for resolving the detected trouble. During the trouble resolution process, the ANXO Help Desk communicates with all ANX Participants who are involved in the trouble resolution process. The ANX Participants involved in the trouble resolution process can track the status of the ANX Trouble Ticket by sending a status update request to the ANXO Help Desk via the ANXO Trouble Handling interface. Figure 10-15 illustrates the fourth escalation phase in which the ANXO Help Desk communicates with ANX Subscribed TPs, ANX CSPs, and ANX CEPOs to coordinate trouble resolution.

Information exchange via ANXO Trouble Handling interface
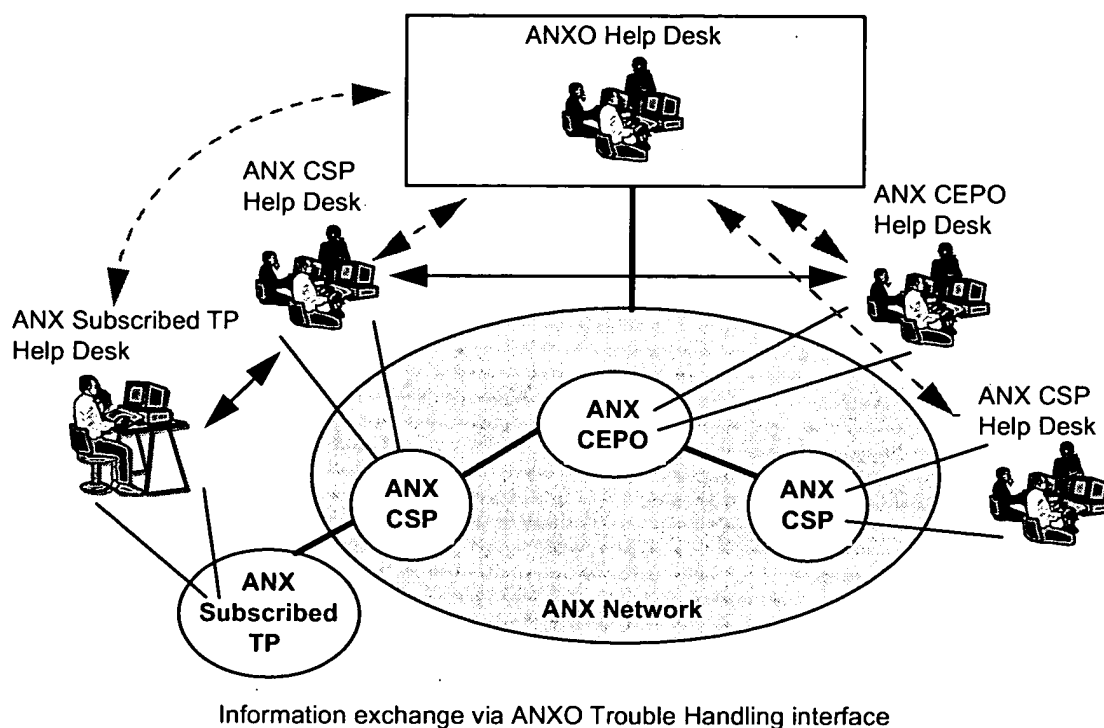
Figure 10-15: Trouble Resolution Coordinated by ANXO Help Desk

10.6.6 ANX Certification Assessment Requirements

[R10-6.: CertAss]   Participation in ANXO Trouble Handling Service

R ANX CSPs/ANX CEPOs **shall** participate in the ANXO Trouble Handling Service and **shall** comply with all day-to-day processes and procedures described in this section, which are needed to escalate unresolved problems to the ANXO.

Measurement Technique:

This metric will only be assessed after the completed Third ANX Certification Assessment Report has been received by the ANX CSP/ANX CEPO Applicant stating that the ANX CSP/ANX CEPO Applicant has passed all metrics stated in that report.

R ANX CSP/ANX CEPO Applicants **shall** successfully complete all one-on-one processing, configuration, and testing with the ANXO in order to participate in the ANXO Trouble Handling Service in full compliance with all the processes described in this section prior to ANX Certification Assessment.

10.6.7 ANX Certificati n Verification Requirements

[R10-6.: CertVer]   Participation in ANXO Trouble Handling Service

R   ANX CSPs/ANX CEPOs **shall** subscribe to the ANXO Trouble Handling Service and **shall** only escalate to the ANXO troubles that cannot be resolved among the effected ANX Participants.

Measurement Technique:

R   ANX CSPs/ANX CEPOs **shall** report each quarter that they continue to comply with the Trouble Handling and Escalation Processes defined in this section.

10.6.8 Summary of ANXO Trouble Handling Service Interface Requirements

Table 10-12 provides the summary of ANXO Trouble Handling service interface requirements.

ANX Certification Requirements For ANX Trouble Handling Service Interface								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
10-	6	Yes	Yes	Participation in ANXO Trouble Handling Service for escalating to the ANXO troubles that cannot be resolved among effected ANX Participants	Compliance	Yes	Quarterly	PDF

Table 10-12: Summary of ANXO Trouble Handling Service Interface Requirements

10.7.3 Summary of ANX CSP/ANX CEPO-ANXO IPSec Interface Requirements

Table 10-13 provides the summary of ANX CSP/ANX CEPO-ANXO IPSec interface requirements.

ANX Certification Requirements For ANX CSP/ANX CEPO-ANXO IPSec Interface								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
10-	7	Yes	Yes	Support of ANX Certificate based IPSec Communications with the ANXO	Compliance	Yes	Quarterly	PDF

Table 10-13: Summary of ANX CSP/ANX CEPO-ANXO IPSec Interface Requirements

10.7 ANX CSP/ANX CEPO-ANXO IPSec Interface

The sensitive nature of the communications between the ANX CSPs, ANX CEPOs and the ANXO requires that confidentiality and integrity be assured as this information crosses the ANX Network. As the ANX Participants have chosen to deploy an infrastructure to support IPSec for exactly this purpose it would be ideal to use this infrastructure to secure these communications. Therefore, the ANX Certified Service Providers in the ANX Network must support the IPSec protocol to communicate with each other and the ANXO.

Further information on the ANXO IPSec test point and information on retrieving certificates can be retrieved from the ANX Network accessible ANXO web site.

10.7.1 ANX Certification Assessment Requirements

[R10-7.: CertAss]   Support of ANX Certificate Based IPSec Communications with ANXO

R ANX CSPs/ANX CEPOs **shall** support ANX Certificate based IPSec communications with the ANXO. IPSec implementations **shall** be certified by an independent third party for use on the current ANX Network Release, presently ICSA.

Measurement Technique:

This metric will only be assessed <u>after</u> the completed Third ANX Certification Assessment Report has been received by the ANX CSP/ANX CEPO Applicant stating that the ANX CSP/ANX CEPO Applicant has passed all metrics stated in that report.

R ANX CSP/ANX CEPO Applicants **shall** successfully connect to the ANXO IPSec test point and **shall** complete all the necessary testing with the ANXO for ANX Certification Assessment.

10.7.2 ANX Certification Verification Requirements

[R10-7.: CertVer]   Support of ANX Certificate Based IPSec Communications with ANXO

R ANX CSPs/ANX CEPOs **shall** support ANX Certificate based IPSec communications with the ANXO. IPSec implementations **shall** be certified by an independent third party for use on the current ANX Network Release, presently ICSA.

Measurement Technique:

R ANX CSPs/ANX CEPOs **shall** report each quarter that they continue to support IPSec communications with the ANXO.

11. Appendix A: Candidate Enhancements Beyond ANX Release 1

Additional certification requirements which are under consideration are listed in this "Appendix A". These may be in the form of additional metrics to be measured, stricter ranges for Service Quality, improved measurement techniques, or additional reporting requirements.

An item initially added to this "Appendix A" is considered to be a potential Candidate.

A potential Candidate which has been described in a higher level of detail is considered to be an Objective. An Objective contains the word "**should**" and is marked with an "O" in the margin. Objectives may be changed or deleted when deemed unfeasible.

Candidates or Objectives may eventually be reclassified as a Requirement. A Requirement contains the word "**shall**" and is marked with an "R" in the margin. Other Candidates, Objectives or Requirements may be added in the future.

11.1 Applications

Applications such as real-time video or audio (isochronous traffic) and multipoint or multicast applications may be considered beyond ANX Release 1.

11.2 Network Services

11.3 Interoperability

O ANX CEPOs **should** support SVCs with QoS selection parameters.

O ANX CSPs **should** support dynamic and scheduled inter-ANX CSP bandwidth reservation for ANX Subscribed TPs.

O Metrics and architecture **should** be evaluated and defined with respect to connectivity for ANX Subscribed TPs outside of North America.

O Increased levels of automation **should** be provided for operation of the ANX routing registry and route server.

11.3.1 CIDR (Route) Aggregation Efficiency

O ANX CSPs **should** use CIDR [8] to aggregate customer addresses in announcements to peers.

Measurement Technique:

O For ANX Certification Assessment, ANX CSPs **should** document current practices using CIDR to configure routing tables such that customer addresses are aggregated in announcements to peers.

O For ANX Certification Verification, ANX CSPs **should** document monthly the set of network numbers and aggregated prefixes they announced within the last month and that they continue to use CIDR to configure routing tables such that customer addresses are efficiently aggregated in announcements to peers. Additionally, the ANX CSP **should** make a quantitative analysis of the efficiency of its route aggregation, and **should** provide this analysis to the ANXO.

11.3.2 RPSL

O Routing policy is currently specified using RIPE 181. RIPE 181 has been superseded by Routing Policy Specification Language (RPSL), as specified in RFC 2280. The processes and the document **should** be updated to reflect the use of RPSL vice RIPE 181.

11.4 Performance

11.4.1 Internet Service Provider Metrics

Better tools will lead to more finely tuned requirements and measurement techniques in several areas, such as packet loss, delay, throughput, and routing protocol stability.

11.4.1.1 IP Hop Count Metric

It may be reasonable to limit the number of IP routers that traffic traverses from one ANX Subscribed TP to another within the ANX. The limit may depend on whether the path crosses international boundaries, oceans, etc.

11.4.1.2 Bulk Flow Capacity Metric

Bulk flow capacity indicates the throughput available to an ANX Subscribed TP with no network load or cross-traffic. This would represent the best performance, limited by facilities, and not by network load conditions. This may differ from the throughput metric, which is the throughput available to an ANX Subscribed TP at any time of day.

11.4.1.3 Link Capacity Metric

O All links between network elements of an ANX CSP **should** be adequately dimensioned for the traffic load which they carry. These include links internal to the ANX CSP, links to ANX Subscribed TPs, the ANX-EP, and to other ANX CSPs.

11.4.1.4 Packet Reordering Metric

A requirement limiting the reordering of packets in TCP or other streams. Reordering can be an indication of route flapping, bad load-balancing algorithms, etc., and is detrimental to application performance (delay and throughput).

11.4.1.5 Packet Loss Rate Criteria

O   C_PLR **should** be 0.03%.

11.4.1.6 Router SNMP Polling Period

O   SNMP polling period of 15 minutes **should** be studied during ANX Release 1 production, with regard to routing processing overloads. This is used for Access Link Utilization statistics collection.

11.4.1.7 Randomness of Test Data

O   The test files **should** contain random data, that cannot be efficiently compressed. The test application **should** generate new random data each time; i.e., the contents will not be predictable from one test to another.

11.4.1.8 Routing Table Configuration Metric

Router configuration errors, which are more likely to occur with manual route configurations, are known to be a major source of interdomain routing instability and poor network performance, sometimes to the extent of losing network reachability, blackholing of legitimate traffic, brownouts or blackouts that can last for hours. Configuration tools that automate BGP-4 route configurations (which are available for various routers) help eliminate this problem. Currently, use of automated tools are not required for ANX CSPs to assure minimization of routing table configuration errors. However, ANX CSPs are responsible for checking correctness of routing table configurations, and avoiding erroneous route announcements.

O   The ANX CSP **should** use an automated tool of some kind to generate and check router configuration files.

11.4.1.9 Route Determinism Metric

O   Routes through the ANX **should** be deterministic in the sense that packets from any source host to any destination host, in the absence of a failure or explicit change in network configuration, follows the same path. This objective discourages, for example, an undesirable mechanism for load sharing where alternate packets are sent via two different paths to the same destination. (While such an algorithm does balance load in the network, the resulting packet reordering can be detrimental to application performance.)

11.4.1.10 Route Filtering

Make some requirement regarding filtering of routes by ANX CSPs. For example, ANX Routes can have limited size prefixes and ANX CSPs can be required not to filter any legitimate ANX route.

11.4.1.11 Routing Update Traffic Metric

The ANX CSP can measure, or otherwise evaluate, the volume of BGP update messages arriving to and generated by its routers. The ANX CSP should use some sort of route-flap dampening algorithm.

11.4.2 Exchange Point Metrics

Performance requirements specific to ANX Exchange Points.

11.4.2.1 Network Edge-to-edge Cell Latency Metric

O Network edge-to-edge cell latency is defined as the one-way delay of an ATM Cell to traverse an ANX CEPO network. The average cell latency measured from edge-to-edge in an ANX CEPO network (not including ANX CSPs' border routers) **should** not exceed 25 msec.

Measurement Technique:

O Every month, ANX CEPOs **should** provide the ANXO average network edge-to-edge cell latency measurements carried out during busy hours between the edges of its network. ANX CEPO **should** measure average cell latency over at least one hundred cell measurements spaced out over time (e.g. 1 cell/minute) during busy hours of a day, and **should** repeat this every day for a month. The ANX CEPO **should** report to the ANXO average cell latency measurements for each day, as well as the average cell latency calculated over all measurements of the month. The ANX CEPO can use a broadband traffic analyzer to generate and send cells from one port and to capture them at another port to make such cell latency measurements.

11.4.2.2 ATM Traffic Shaping/Policing at ANX CEP/ANX CSP Routers Connecting to ANX CEP

O The configuration of ATM interfaces on the ANX CSPs' border routers may also affect the overall performance (e.g., Cell loss) of the ANX CEPO's ATM service. Thus, the ANX CEPO's ATM switch and the ATM interfaces on the border routers of the ANX CSPs **should** be considered in order to ensure that the ANX CEPO service (as viewed by the ANX CSPs) meets the performance requirements specified by the ANX.

O In order to provide the level of performance required by ANX, the ANX CEPO **should** ensure satisfactory performance of border router interfaces of the ANX CSPs connecting to the ANX CEP. In particular, the ANX CEPO **should** determine, document, impose and monitor

performance requirements of the ANX CSPs' border router interfaces, including but not limited to ATM traffic policing and shaping, necessary in order for the ANX CEP to meet the Performance Requirements described in Section 1 of this document. Assisting the ANX CSPs in selecting and configuring the ATM interfaces on their border routers **should** be part of the service that the ANX CEPO provides to ANX CSPs.

11.4.2.3 Access Link Utilization Metric

ANX CSPs can provide to ANX Subscribed TPs or the ANXO graphs of link utilization (average, peak 5-minute interval, 95th quantile, etc.), as measured from MIB variables in the access router. These data can be made available in an automated fashion, e.g., on web pages.

11.4.2.4 Metrics Based on Specific ANX Subscribed TP Usage Patterns

Some metrics for later releases, or their measurement techniques, could be designed more specifically for certain types of ANX Subscribed TPs and their particular usage patterns. This can be generalized to the notion of several levels of certified service.

11.5 Reliability

11.5.1 Outage Index Metric

An outage index is used to quantify the effects of major service interruptions on customers.

A metric measuring the effects of outages similar to the one developed by Bellcore and adopted by T1A1.2 needs to be developed [Part 6, Ref# 14]. It needs to combine the length of the outage with the number of customers affected and with the services affected to estimate the overall effect of an outage. The idea is to measure the "pain" of each outage. This metric needs to be developed and designed specifically for the ANX CSP network.

O   The outage index **should** be less than some constant.

At this time, it is impossible to be more specific about the constant. This constant will have to be specifically developed for this application. It will in all likelihood be based on information coming from the first few year of operation.

Measurement Technique:

O   Information on all total outages in an ANX CSP **should** be collected and the outage index calculated for each outage. The outage index for a set of outages is the sum of the outage indices for each outage. The outage index over a month (or quarter) **should** be included on a control chart. The control charts contain the control limits that can be used to test whether the outage index meets objectives. Trend analyses **should** be conducted on the outage index.

11.5.2 Soft Unavailability

A hard outage event is one that can cause "hard" unavailability. Hard unavailability is present when the service is totally unavailable (i.e., the "system" is "dead" and offers no response to customer inputs). Soft outage events can cause "soft" unavailability, which occurs when the service is available but the performance (e. g., response time, latency, error rate, packet loss rate) falls below tolerable thresholds. In ANX Release 1 only the hard outage events are considered. Soft outage events are under study and may be added in a later release.

Since non-service affecting outage events represent events which may have caused the ANX CSP network to lose some measure of its reliability (during the outage the failure margin is reduced) and this reduction in safety margin may be cause for concern, the non-service affecting events **should** be analyzed to provide an ongoing gauge of this margin.

11.5.3 Access Network Availability Metric

The Access Network may consist of a router and dedicated access line (such as a T1 line or switched network such as Frame Relay) between the ANX Subscribed TP's local network and the ANX CSP ingress router. If this network fails the ANX Subscribed TP will be isolated and unable to access the ANX CSP.

Other access methods such as dialup lines may also be used by the ANX Subscribed TP additionally, but reliability requirements are not defined in this document for such alternate access types.

11.5.4 ANX CSP Connectivity Upon Failure Metric

O For every link and network element carrying ANX Traffic, the ANX CSP **should** have an understanding of how ANX Traffic will flow in the event of failure of that single link or element.

Measurement Technique:

O The actual physical layout of each network **should** be provided by each ANX CSP at ANX Certification Assessment. This includes the layout of each access link to other networks. For every link and network element carrying ANX Traffic, the ANX CSP **should** describe how the traffic will flow in the event of failure of that single link or element, in a report to the ANXO.

11.6 Business Continuity and Disaster Recovery

Enhancements metrics beyond ANX Release 1 are under study. Enhancements under consideration include full NOC redundancy.

11.7 Security

11.7.1 Security Policy Metrics

11.7.1.1 Industry Analysis

Security policies are very important, as they identify and communicate the philosophy and activities of an organization regarding network protection. Policies and procedures describe the strategic, "why we do this," aspects of operations, as well as the tactical, "how we do this," portions. Poorly written policies nearly always result in poor security. Although the security implementation based on a poor policy may be accidentally strong at first, it usually weakens with time. For these reasons, a strong policy is the best first step in ensuring the protection of data on a network.

In an environment such as the ANX which involves numerous ANX CSP/ANX CEPOs, a foundation of security policy must be established to ensure uniformity in baseline security practices. While individual ANX CSP/ANX CEPO policies can and should involve additional measures beyond those set forth in this section, the basic policies described in the following metrics will allow the ANXO and ANX Subscribed TPs to verify the security characteristics of the ANX. This section contains the general security policy requirements for the ANX; other security metrics sections also include policy requirements that are less general in nature and more closely relate to those sections.

11.7.1.2 ANX Certification Assessment Requirements

Several organizations monitor the state of security of hosts on the Internet and report vulnerabilities discovered in Operating Systems, applications, and protocols. Additionally, many groups publish workarounds and patches for the various security vulnerabilities that are discovered. Numerous mailing lists are available that distribute this information, including Carnegie Mellon's Computer Emergency Response Team (CERT), bugtraq, and the Department of Energy's Computer Incident Advisory Capability (CIAC). These sources of security information will make ANX CSP/ANX CEPOs more secure by allowing them to patch vulnerabilities in a timely fashion.

11.7.1.2.1 Security Bulletin Monitoring and Implementation Policy

O The ANX CSP/ANX CEPO **should** implement a policy of monitoring and implementing security bulletins that originate from the various security mailing lists on the Internet. Examples of such lists include CERT, bugtraq, CIAC, etc.

Measurement Technique:

O The ANX CSP/ANX CEPO **should** supply the ANXO a summary of its written policy describing how it monitors and implements security bulletins prior to ANX Certification Assessment.

11.7.1.2.2 Plan and Implementation of Solutions Addressing Vulnerabilities

O The ANX CSP/ANX CEPO **should** plan for and implement solutions and/or operational changes to address known vulnerabilities within a specified amount of time.

Measurement Technique:

O The ANX CSP/ANX CEPO **should** provide to the ANXO a plan for the implementation of solutions and/or operational changes to address known vulnerabilities within a specified amount of time. The ANXO **should** outline a schedule for such deadlines, which may vary depending on the severity of the event. The ANX CSP/ANX CEPO **should** implement planned solutions within the scheduled deadlines.

New systems introduced within ISP networks often allow for remote management to ease the administrative burden for system maintainers. While such remote management is very useful from a cost and responsiveness perspective, it could expose the network to security vulnerabilities if not done carefully. The security policy of an ANX CSP/ANX CEPO employing remote access to configure its routers and hosts must address securing the path between the management system and the managed host or router. The ANX Subscribed TP community will benefit from such a practice because the possibility of attacks against ANX CSP/ANX CEPO infrastructures that could result in a denial of service will be lowered.

11.7.1.2.3 Encryption/Authentication Policy for Remote Configuration of Hosts/Routers/Switches

O If ANX CSP/ANX CEPO workstations, routers and switches are configured remotely using in-band means (such as Telnet), the ANX CSP/ANX CEPO **should** have and implement a policy governing that encrypted, authenticated paths must be used to carry the configuration sessions.

Measurement Technique:

O The ANX CSP/ANX CEPO **should** provide ANXO its written policy for using encrypted, authenticated paths to carry in-band configuration commands for the hosts, routers and switches used for the ANX Network Service. If solutions are not available from the manufacturer of a router, workstation or switch in use by an ANX CSP/ANX CEPO, the ANX CSP/ANX CEPO must inform the ANXO in writing which types of platforms are in use that cannot support encrypted in-band management.

11.7.1.3 ANX Certification Verification Requirements

Security policies often change in an organization because of the introduction of new services or even new types of vulnerabilities. Because of their changebility, the ANXO must be periodically kept up-to-date regarding ANX CSP/ANX CEPO policies.

11.7.1.3.1 Security Bulletin Monitoring and Implementation Policy

O The ANX CSP/ANX CEPO **should** implement a policy of monitoring and implementing security bulletins that originate from the various security mailing lists on the Internet. Examples of such lists include CERT, bugtraq, CIAC, etc.

Measurement Technique:

O The ANX CSP/ANX CEPO **should** resubmit ANXO on a yearly basis a summary of its written policy describing how it monitors and implements security bulletins. If an ANX CSP/ANX CEPO changes or updates its policy regarding monitoring and implementation of security bulletins, it **should** send the ANXO a summary of the new policy.

11.7.1.3.2 Plan and Implementation of Solutions Addressing Vulnerabilities

O The ANX CSP/ANX CEPO **should** plan for and implement solutions and/or operational changes to address known vulnerabilities within a specified amount of time.

Measurement Technique:

O The ANX CSP/ANX CEPO **should** provide to the ANXO on a yearly basis a summary of any accomplished milestones addressing known vulnerabilities within the past year, and an updated plan for the implementation of solutions and/or operational changes to address known and newly-discovered vulnerabilities within a specified amount of time. The ANXO **should** outline a schedule for such deadlines, which may vary depending on the severity of the event. The ANX CSP/ANX CEPO **should** implement planned solutions within the scheduled deadlines. The ANX CSP/ANX CEPO **should** also inform the ANXO upon any operational changes or its implementation of specific solutions that address any known vulnerabilities, whenever such vulnerabilities are eliminated.

11.7.1.3.3 Encryption/Authentication Policy for Remote Configuration of Hosts/Routers/Switches

O If ANX CSP/ANX CEPO workstations, routers and switches are configured remotely using in-band means (such as Telnet), the ANX CSP/ANX CEPO **should** implement a policy of using encrypted, authenticated paths to carry in-band configuration sessions.

Measurement Technique:

O If an ANX CSP/ANX CEPO changes its policy regarding remote configuration of routers, hosts or switches, the ANX CSP/ANX CEPO **should** send the ANXO a summary of the new policy. Additionally, on a yearly basis, the ANX CSP/ANX CEPO **should** send the ANXO a summary of its policy regarding remote configuration of routers and hosts. This summary **should** include a list of those router and workstation platforms whose vendors do not yet support encrypted, authenticated in-band management.

11.7.1.4 Summary of Security Policy Requirements

Table 11-1 summarizes the general security policy metrics.

ANX Certification Requirements For Security Policy								
Section Number	Reference Number	ISP/ ANX CSP	EPO/ ANX CEPO	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
	1	Yes	Yes	Security bulletin monitoring and implementation policy	Compliance	Yes	Annually or when changes occur	PDF
	2	Yes	Yes	Plan and implementation of solutions addressing vulnerabilities	Compliance	Yes	Annually or when changes occur	PDF
	3	Yes	Yes	Encryption/Authentication Policy for remote configuration of routers, hosts and switches	Compliance	Yes	Annually or when changes occur	PDF

Table 11-1.: Security Policy Requirements Summary

O It is possible that, in the future, ANX CSPs/ANX CEPOs will be required to submit their overall network security policy documentation to the ANXO so that the ANXO can ensure a uniform security policy throughout the ANX CSP/ANX CEPO infrastructure.

11.7.2 Authentication & Confidentiality Metrics

11.7.2.1 ANX Certification Assessment Requirements

11.7.2.1.1 Third-Party Security Audits Against Use of Trivial Passwords

O An ANX CSP/ANX CEPO **should** not use any trivial passwords on a host, on a router, or as an SNMP community string. Passwords based on the operating system or machine name, or any of the default login names (root, superuser, sync, bin, Administrator, etc.) **should** not be used. An ANX CSP/ANX CEPO **should** not use the words "public" or "private" as the SNMP community string.

Measurement Technique:

O The ANX CSP/ANX CEPO **should** contract with a third-party auditor, at ANX Certification Assessment, to perform tests against its routers and hosts that will be carrying ANX Traffic, attempting to login using trivial passwords. This third-party auditor report **should** be provided to the ANXO. Upon request, the ANXO **should** provide to the ANX Subscribed TPs the name of the third-party that conducted the test, as well as the date on which the test was conducted. The ANXO **should not** provide the results of the test.

11.7.2.2 ANX Certification Verification Requirements

11.7.2.2.1 Third-Party Security Audits Against Use of Trivial Passwords

O An ANX CSP/ANX CEPO **should** not use any trivial passwords on a host, on a router, or as an SNMP community string. Passwords based on the operating system or machine name, or any of the default login names (root, superuser, sync, bin, Administrator, etc.) **should** not be used. An ANX CSP/ANX CEPO **should** not use the words "public" or "private" as the SNMP community string.

Measurement Technique:

O The ANX CSP/ANX CEPO **should** contract with a third-party auditor on a quarterly basis to perform tests against its routers and hosts carrying ANX Traffic, attempting to login using trivial passwords. This third-party auditor report **should** be sent to the ANXO. Upon request, the ANXO **should** provide to the ANX Subscribed TPs the name of the third-party that conducted the test, as well as the date on which the test was conducted. The ANXO **should not** provide the results of the test.

11.7.2.3 Filtering

No candidate enhancements have yet been identified for filtering metrics. It is possible that for future releases of ANX, ANX CSPs will be required to deter other common types of attacks by dropping selected packet types.

11.7.2.4 Suspicious Activity Detection

No candidate enhancements have yet been identified for suspicious activity detection.

11.7.2.5 Interoperability Security Metrics

No candidate enhancements have yet been identified for interoperability security metrics.

11.8 Customer Care / Help Desk

11.8.1 Customer Satisfaction Ratio

The Customer Satisfaction Ratio provides an overall indication of customer (ANX Subscribed TP/ANX CSP) satisfaction with their use of an ANX CSP/ANX CEPO. The Customer Satisfaction Ratio is measured on the following scale:

> { did not provide satisfactory results,
>   almost provided satisfactory results,
>   provided satisfactory results,
>   exceeded satisfactory results }

The Customer Satisfaction Ratio is expressed as a percentage of all customers meeting a certain satisfaction level.

O The Customer Satisfaction Ratio **should** be at least 95% of representative samples of all customers with provided satisfactory results or exceeded satisfactory results. (Note: non-favorable responses caused by events outside the control of ANX CSPs will be excluded from the overall counts).

Measurement Technique:

O The Customer Satisfaction Ratio **should** be surveyed periodically by the ANXO to measure the ongoing compliance with this metric, as part of the ANX Certification Verification process. ANXO **should** use two separate customer satisfaction surveys, one for ANX CSPs and the other for ANX CEPOs, as instruments to measure customer satisfaction ratio. Surveys **should** be filled out by the customers of service providers, namely ANX Subscribed TPs for ANX CSPs, and ANX CSPs for ANX CEPOs. Survey forms **should** be posted at the ANX Network accessible ANXO web site for access by ANX Participants. There **should** be no requirement for an ANX CSP/ANX CEPO to perform any reporting to ANXO regarding this metric. ANXO **should** provide the results of Customer Satisfaction surveys to the ANX CSP/ANX CEPO as part of the Quarterly ANX Certification Verification Reports for Customer Care / Help Desk metrics.

11.8.2 Customer Care Help Desk Scheduled Service Time

O The Scheduled Service Time for the Customer Care Help Desk **should** be at least 12 hours per day, from 9am to 6pm in each time zone, 5 days per week.

11.8.3 Customer Car Help Desk Availability

O The Customer Care Help Desk Availability **should** be at least 99.95%, corresponding to a total unavailability of no more than 1.56 (or 1.17) hours per year for 12 (or 9) hour scheduled service time.

11.8.4 Billing

The need for more stringent targets of the initial metrics is under study. In addition the following parameters are being considered.

11.8.4.1 Billing Accuracy

The Billing Accuracy refers to the percentage of the bills that are accurate.

O The Billing Accuracy **should** be better than 97.5%.

O The Billing Accuracy **should** be provided prior to certification time by the ISP.

11.8.4.2 Billing Help Desk ACD Maximum Holding Time

The Billing Help Desk ACD Maximum Holding Time is defined as the maximum amount of time a caller is kept on hold until connected to a human representative. This parameter is measured in seconds for a Billing Help Desk caller percentage, starting from when a caller arrives in a Billing Help Desk queue waiting for a representative until connection with the representative is established.

O The Billing Help Desk ACD Maximum Holding Time **should** be less than 30 seconds for 90% of all Billing Help Desk callers and less than 60 seconds for 98% of all Billing Help Desk callers.

O The parameter **should** be provided prior to certification time by the ISP.

11.8.4.3 Billing Help Desk Speed Of Answer

Under Study.

11.8.4.4 Billing Help Desk Caller Abandon Ratio

The Billing Help Desk Caller Abandon Ratio is defined as the number of Billing Help Desk callers kept on hold for 30 seconds and abandons before being connected to a representative as a percentage of the total number of Billing Help Desk callers.

O The Billing Help Desk Caller Abandon Ratio **should** be less than 1%.

· O The parameter **should** be verified through monthly reports by the ISP.

11.8.4.5 ACD Maximum Menu Length to Reach a Billing Help Desk Representative

This parameter is defined as the maximum number of voice menus a caller may need to navigate in order to reach a (queue for a) human Billing Help Desk representative.

O   The Menu Length to Reach a Billing Help Desk Representative **should** be no greater than 1.

O   The parameter **should** be verified by the ISP.

11.8.5 Service Activation

The need for more stringent targets of the initial metrics is under study. In additional the following parameters are being considered.

11.8.5.1 Service Activation and Provisioning Problem Ratio

The Service Activation and Provisioning Problem Ratio refers to the number of service activation and provisionings that experienced problems as a percentage of all service activations and provisionings.

O   The Service Activation and Provisioning Problem Ratio **should** be no more than 5%.

O   The parameter **should** be verified through monthly reports by the ISP.

11.8.5.2 Service Activation Help Desk ACD Maximum Holding Time

The Service Activation Help Desk ACD Maximum Holding Time is defined as the maximum amount of time a caller is kept on hold until connected to a human representative. This parameter is measured in seconds for a Service Activation Help Desk caller percentage, starting from when a caller arrives in a Service Activation Help Desk queue waiting for a representative until connection with the representative is established.

O   The Service Activation Help Desk ACD Maximum Holding Time **should** be less than 30 seconds for 90% of all Service Activation Help Desk callers and less than 60 seconds for 98% of all Service Activation Help Desk callers.

O   The parameter **should** be provided prior to certification time by the ISP.

11.8.5.3 Service Activation Help Desk Caller Abandon Ratio

The Service Activation Help Desk Caller Abandon Ratio is defined as the number of callers kept on hold for 30 seconds and abandons before being connected to a representative as a percentage of the total number of Service Activation Help Desk callers.

O   The Caller Abandon Ratio **should** be no more than 0.5%.

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O The parameter **should** be verified through monthly reports by the ISP.

11.8.5.4 ACD Maximum Menu Length to Reach a Service Activation Help Desk Representative

This parameter is defined as the maximum number of voice menus a caller may need to navigate in order to reach a (queue for a) human Service Activation Help Desk representative.

O The ACD Maximum Menu Length to Reach a Service Activation Help Desk Representative **should** be no greater than 1.

O The parameter **should** be verified by the ISP.

11.8.6 Service Deactivation

11.8.6.1 Service Deactivation Help Desk Maximum Holding Time

The Service Deactivation Help Desk Maximum Holding Time is defined as the maximum amount of time a caller is kept on hold until connected to a human representative. This parameter is measured in seconds starting from when a caller arrives in a queue waiting for a representative until connection with the representative is established.

O The parameter **should** be provided prior to certification time by the ISP.

11.8.6.2 Service Deactivation Help Desk Caller Abandon Ratio

The Service Deactivation Help Desk Caller Abandon Ratio is defined as the number of callers kept on hold for 30 seconds and abandons before being connected to a representative as a percentage of the total number of Service Deactivation Help Desk callers.

O The Caller Abandon Ratio **should** be no more than 0.5%.

O The parameter **should** be verified through monthly reports by the ISP.

11.8.7 WWW/Electronic Help Desk

The WWW/FAQ Electronic Help Desk is a bulletin board function that allows on-line access to FAQ information, notifications, and other ISP information.

11.8.7.1 Introduction

O Monthly reports regarding electronic customer care facilities **should** be provided with the following indications:

    1. Frequency of use

    2. Accuracy of provided information

   3. Currentness of the provided information

11.8.7.1.1 WWW/FAQ Electronic Help Desk Scheduled Service Time

The WWW/FAQ Electronic Help Desk Scheduled Service Time is the time that the WWW/FAQ Electronic Help Desk is planned to be offered. This parameter is measured in days per week and hours per day.

O The Scheduled Service Time for the WWW/FAQ Electronic Help Desk **should** be available 24 hours per day, and 7 days per week.

11.8.7.1.2 WWW/FAQ Electronic Help Desk Availability

WWW/FAQ Electronic Help Desk Availability is defined as the amount of time that the WWW/FAQ Electronic Help Desk is available. The Availability is expressed as a percentage of the total time that includes outages and repairs.

O The WWW/FAQ Electronic Help Desk Availability **should** be at least 99.90%, corresponding to a total unavailability of no more than 2.6 hours per year.

O The parameter **should** be verified through monthly reports kept by the ISP.

11.8.7.1.3 WWW/FAQ Electronic Help Desk Data Currentness

The WWW/FAQ Electronic Help Desk Data Currentness expresses how current the information provided through the WWW/FAQ Electronic Help Desk is. under study

11.9 Trouble Handling

Some Trouble Handling candidate enhancements are listed in this section. Other enhancements are under study.

11.9.1 E-mail Response Time

O The Trouble Help Desk e-mail address **should** meaningfully respond by providing a reply within 4 hours (24 hours x 7 days/week), at least 99.95% of the time (e.g., open ANX Trouble Ticket).

Measurement Technique:

O ANX CSPs and ANX CEPOs **should** submit quarterly reports (monthly breakdowns) to the ANXO giving statistics on e-mail response time.

11.9.2 Trouble Close-out Time

The Trouble Close-out Time refers to the time it takes to resolve a trouble successfully and close the corresponding ANX Trouble Ticket.

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O The Trouble Close-out Time depends on the trouble classification and **should** meet certain time Criteria. These Criteria are to be determined.

11.9.3 Trouble Help Desk ACD Maximum Holding Time

The Trouble Help Desk ACD Maximum Holding Time is defined as the maximum amount of time a caller is kept on hold until connected to a human representative. This parameter is measured in seconds for a Trouble Help Desk caller percentage, starting from when a caller arrives in a Trouble Help Desk queue waiting for a representative until connection with the representative is established.

O The Trouble Help Desk ACD Maximum Holding Time **should** be less than 30 seconds for 90% of all Trouble Help Desk callers and less than 60 seconds for 98% of all Trouble Help Desk callers.

O Assessment **should** be confirmed by submitting a report to the ANXO giving hold time statistics for the Trouble Help Desk over the past 6 months of service.

11.9.4 Trouble Help Desk Repeated Call Ratio

The Trouble Help Desk Repeated Call Ratio refers to the number of calls that refer to earlier closed problems as a percentage of all Trouble Help Desk calls.

O The Trouble Help Desk Repeated Call ratio **should** be less than 4%.

O The parameter **should** be verified through monthly reports by the ISP.

11.9.5 Trouble Help Desk First Call Problem Resolution Ratio

The Trouble Help Desk First Call Problem Identification Ratio is defined as the number of problems that are correctly identified and resolved on the first call, as a percentage of all first calls. A first call is defined as the call where a customer first identifies a particular problem.

O The Trouble Help Desk First Call Problem Identification Ratio **should** be better than 85%.

O The parameter **should** be verified through monthly reports by the ISP.

11.9.6 Trouble Help Desk Caller Abandon Ratio

The Trouble Help Desk Caller Abandon Ratio is defined as the number of callers kept on hold for 30 seconds and abandons before being connected to a representative divided by the total number of callers connected to a representative. This parameter is a defined as a percentage of the total number of callers.

O The caller Abandon Ratio **should** be less than 1%.

O The parameter **should** be verified through monthly reports by the ISP.

11.9.7 ACD Maximum Menu Length to Reach a Troubl Help Desk Repres ntativ

This parameter is defined as the maximum number of voice menus a Trouble Help Desk caller may need to navigate in order to reach a (queue for a) human Trouble Help Desk representative.

O The Menu Length to Reach a Trouble Help Desk Representative **should** be no greater than 1.

O The parameter **should** be verified through monthly reports by the ISP.

11.9.8 Refinement of Severity Classifications

Periodically the ANXO will meet with ANX CSP, ANX CEPO, and the AIAG to refine the severity classifications, metric values, and add new metrics in order to standardize and improve the overall trouble handling performance in the ANX system.

11.9.9 Common Trouble Ticket Formats

O Common ANX Trouble Ticket formats **should** be established for use among ANXO, ANX CSPs, and ANX CEPOs.

Periodically the ANXO will meet with ANX CSP, ANX CEPO, and the AIAG to work towards interchangeable ANX Trouble Ticket formats between service providers in order to standardize and improve the overall trouble handling performance in the ANX system.

11.9.10 System-to-System Common Interface Specifications

O System-to-system common interface specifications **should** be established between ANX CSPs, ANX CEPOs and ANXO.

PART 3

ANX Registration and Subscription for Trading Partners

Part 3 - ANX Registration and Subscription for Trading Partners

Table of Contents

1. INTRODUCTION

1.1 Scope of the ANX Registration and Subscription Process for Trading Partners

ANX Registration and Subscription for Trading Partner leads to recording a Trading Partner in the ANX Overseer (ANXO) Directory as being ANX Subscribed. ANX Subscribed implies the Trading Partner has met all ANXO requirements for using ANX Service from its ANX Certified Service Provider(s).

1.2 Scope of This Document

This document describes the ANX Registration and Subscription process and the enabling infrastructure of support functions.

The document is organized according to the states that a Trading Partner can have within the ANX Registration and Subscription process plus the support functions required to support that process.

1.3 ANX Registration and Subscription Summary

Figure 1-1 highlights the basic steps of the ANX Registration and Subscription process, which includes: 1) ANX Sponsorship, 2) ANXO Contracting, 3) ANX Registration, and 4) ANX Subscription.
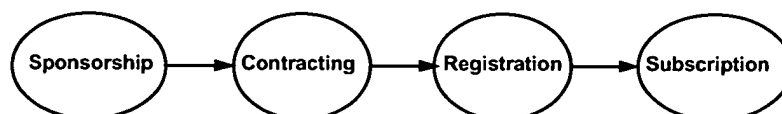
Figure 1-1. ANX Registration and Subscription Process Summary

During ANX Registration and Subscription, a Trading Partner can be in one of four states. All four (4) of these states are made publicly visible by being recorded in the ANXO Directory for that Trading Partner. The four (4) states are:

1. ANX Sponsored

2. ANXO Contracted

3. ANX Registered

4. ANX Subscribed

Figure 1-2 below depicts these states and allowed transitions between them. The document sections that elaborate the process definition for each state are shown.
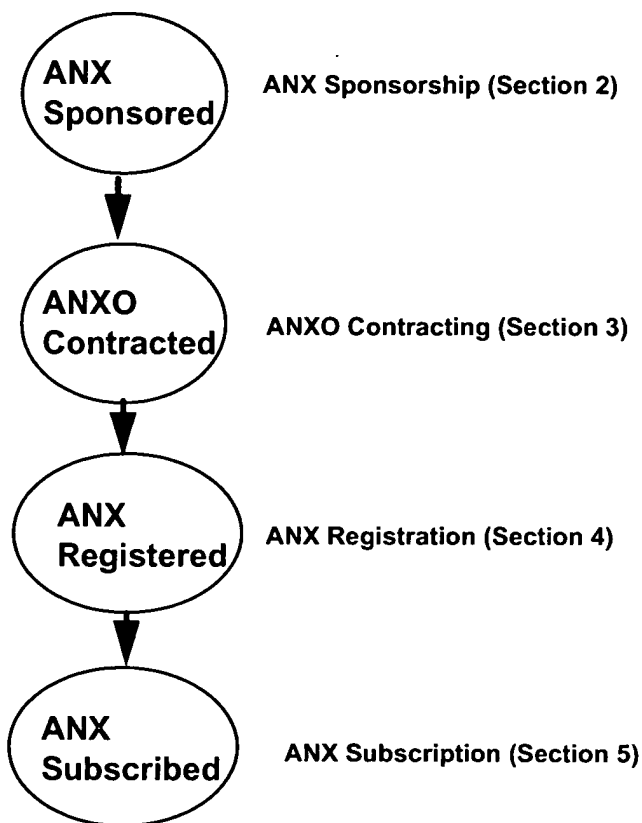
ANX Sponsored — ANX Sponsorship (Section 2)

ANXO Contracted — ANXO Contracting (Section 3)

ANX Registered — ANX Registration (Section 4)

ANX Subscribed — ANX Subscription (Section 5)

Figure 1-2. Trading Partner States During ANX Registration and Subscription Process

1.4   ANXO Directory

The ANXO Directory provides state information for the Trading Partners as they proceed through the process steps required for ANX Subscription. The ANXO Directory divides the information based on (i) publicly visible information and (ii) information accessible only over the ANX Network. The URL for the web site containing the public portion of the ANXO Directory is *http://www.anxo.com*. The URL for the ANX Network accessible portion of the ANXO Directory shall be given to each ANX Participant when they can access the ANX Network.

The Table 1-1 given below demonstrates this division of information.

TRADING PARTNER STATE	ANX NETWORK ACCESSIBLE PORTION OF ANXO DIRECTORY	PUBLIC PORTION OF ANXO DIRECTORY
ANX Sponsored	Yes	No
ANX Contracted	Yes	No
ANX Registered	Yes	No
ANX Subscribed	Yes	Yes

Table 1-1. ANXO Directory

2.   ANX Sponsorship

For the duration of the ANX Service launch, as defined by the AIAG, participation in the ANX Network shall be restricted to automotive Trading Partners sponsored by AIAG approved Authorizing Trading Partners. A Trading Partner does not need to be a member of the AIAG to become ANX Sponsored.

2.1   ANX Sponsorship Process

New Trading Partner Sponsorship Process:

1. A new Trading Partner requests ANX sponsorship from an Authorizing Trading Partner (ATP). ATPs are listed at www.anxo.com.
2. The ATP decides to accept or decline the request based on their business requirement(s).
3. The ATP builds a sponsor record for the new ANX TP. The record is added to the ANXO Sponsored Database.
4. ANXO sends a letter to the TP just entered in the database, inviting the TP to join the ANX network service.
5. TP contacts ANXO, with the understanding that this will initiate the contract, registration, and subscription process.

Process to become an Authorizing Trading Partner:

1. Requirements for application - Must be recommended by one (1) AIAG ANX Implementation Task Force (ITF) Member
2. Candidate ATP submits Application to the ANX ITF.
3. The ANX ITF will consider ATP applications on a periodic basis. For approval, the candidate ATP request must be approved by a minimum of four (4) additional ANX ITF members by a formal vote of the ANX ITF.
4. All approved applications will be added by the ANXO to the ATP Database.

ATP Application Form Requirements:

1. Contact information including Name, address, phone, e-mail address, fax number.
2. Company name with Dunn+Bradstreet report.
3. Description of ANX plans (Who will you be sponsoring, how many, when, why, where).

2.2   ANXO Directory

A portion of the ANXO Directory shall be maintained by the ANXO on a publicly available web site at address *http://www.anxo.com*. Here, the ANXO shall list Authorizing Trading Partner names and contact information. The AIAG shall provide the ANXO with this information.

The other portion of the ANXO Directory shall be maintained by the ANXO on a web site accessible only over the ANX Network. Here, the ANXO shall list ANX Sponsored Trading Partner names and contact information. The Authorizing Trading Partners shall provide the ANXO with this information.

3. ANXO Contracting

ANX Sponsored Trading Partners are eligible to sign an ANXO Contract for Trading Partner with the ANX Overseer. A subsidiary is able to become ANXO Contracted through its parent.

3.1 ANXO Contracting

The ANXO Contracting process shall proceed as follows:

1. Trading Partner obtains an ANXO Service Provisioning Package for Trading Partner.
2. ANXO assigns an ANXO Contract Number.
3. Trading Partner signs each of two copies of the ANXO Contract for Trading Partner and returns both to the ANXO.
4. ANXO signs both copies of the ANXO Contract for Trading Partner and returns one to the Trading Partner.
5. ANXO lists the Trading Partner in the ANXO Directory with its state as ANXO Contracted.

A publicly accessible web page, in English, shall be provided by the ANXO at address *http://www.anxo.com* for frequently asked questions concerning the ANXO Contracting process.

The ANX Registration phase can now begin.

3.2 ANXO Service Provisioning Package for Trading Partner

The ANXO Service Provisioning Package for Trading Partner shall be in English and includes:

1. Cover letter that includes instructions.
2. Two copies of ANXO Contract for Trading Partner.
3. The ANXO Contract for Trading Partner Fee Schedule.
4. ANX Registration Form.
5. ANX Subscription Form.
6. This document [Part 6, Ref. #3]

3.3 ANXO Contract for Trading Partner Fe Schedule

The ANXO Contract for Trading Partner Fee Schedule fees shall be billed by the ANXO. Certain

characteristics of these fees are tabulated the following Table 3-1. Note that one ANX Registration Fee is paid for each ANX Subscription Fee payment.

FEE	HOW OFTEN?	WHEN PAID?	DESTINATION
ANX Registration	Annual, with additional charges/rebates during year if bandwidth increases/decreases	In advance of ANX Registration processing by ANX Overseer	AIAG
ANX Subscription	Annual, with additional charges/rebates during year if bandwidth increases/decreases	In advance of ANX Subscription processing by ANX Overseer; with hourly rate for any re-analysis due to initial failure of criteria	ANX Overseer

Table 3-1. Fee Characteristics

3.4 ANXO Assigned Numbers

Initially, an ANXO Contract Number shall be assigned by the ANXO to each Trading Partner with an ANXO Contract for Trading Partners. The ANXO Contract Number is an unique number assigned by the ANXO to an ANXO Contract. The number is disclosed only to the contractual party.

Upon completion of the ANX Registration process, the Trading Partner shall be assigned an ANXO Account Number.

The format of the ANXO Account Number is as follows:

TP-Z where Z = unique integer and being consecutively assigned. Preassigned numbers are: 0 for the AIAG and 1-11 for the AIAG Telecommunications Project Team members at the time of this writing.

4. ANX Registration

ANXO Contracted Trading Partners are eligible to begin ANX Registration.

A subsidiary company can become ANX Registered through its parent company.

4.1 ANX Registration Process

The ANX Registration process proceeds as follows:

1. Trading Partner completes the ANX Registration Form

2. Trading Partner returns the ANX Registration Form

3. Concurrently with step 2 above, the Trading Partner can send a check completed as shown on the ANXO public web site; otherwise ANXO invoices the Trading Partner for the ANX Registration Fee which is described above in Section 3.3

4. ANXO validates the ANX Registration Fee payment

5. ANXO analyzes the ANX Registration Form

6. Upon satisfactory completion of the ANX Registration Form, the Trading Partner shall be assigned an ANXO Account Number as described in Section 3.4

7. ANXO lists the Trading Partner in the ANXO Directory with its ANXO Account Number and with its state as ANX Registered

A publicly accessible web page, in English, shall be provided by the ANXO at address *http://www.anxo.com* for frequently asked questions concerning the ANX Registration process.

5. ANX Subscription

ANX Registered Trading Partners are eligible to begin ANX Subscription.

Trading Partner shall complete this process for each individual ANX CSP dial-up account or dedicated access connection from each individual Trading Partner location.

5.1   ANX Subscription Process

The ANX Subscription process proceeds as follows:

1. Trading Partner completes the ANX Subscription Form

2. Trading Partner returns the ANX Subscription Form

3. Concurrently with step 2 above, the Trading Partner can send a check completed as shown on the ANXO public web site; otherwise ANXO invoices the Trading Partner for the ANX Subscription Fee which is described above in Section 3.3

4. ANXO confirms that the Trading Partner is ANX Registered

5. ANXO validates the ANX Subscription Fee payment

6. ANXO analyzes the ANX Subscription Form

7. ANXO completes the ANX Subscription Assessment process

8. ANXO sends the Trading Partner an ANX Subscription Report

9. ANXO lists the Trading Partner in the ANXO Directory with its ANXO Account Number and with its state as ANX Subscribed

The Trading Partner is then an ANX Subscribed Trading Partner and, as such, eligible to send ANX Traffic to other ANX Subscribed Trading Partners via the ANX Service.

A publicly accessible web page, in English, shall be provided by the ANXO at address *http://www.anxo.com* for frequently asked questions concerning the ANX Subscription process.

5.2   ANX Subscription Process for each Additional ANX CSP Connection

1. Trading Partner returns the ANX Subscription Form for the additional ANX CSP connection. There is no need for an additional ANX Registration Form

2. Concurrently with step 1 above, Trading Partner can send a check completed as shown on the public ANXO web site; otherwise ANXO invoices Trading Partner for the additional ANX Registration Fee and ANX Subscription Fee for this additional connection

3. ANXO validates the payment

4. ANXO analyzes the ANX Subscription Form for the additional connection

5. ANXO completes the ANX Subscription Assessment process for the additional connection

6. ANXO sends Trading Partner an ANX Subscription Report to confirm the additional ANX Subscription

5.3 Trading Partner Contract with ANX CSP for ANX Service

There shall be an ANXO Contract for Service Provider contractual requirement that obligates an ANX CSP to provide ANX Service only to an ANX Subscribed Trading Partner. Verification of this Trading Partner state can be done by the ANX CSP(s) by inspection of the ANXO Directory.

5.4 ANX Subscription Assessment Requirements

The ANX Subscription Assessment requirements for each individual ANX Subscription are as follows:

1. **ANX Subscription Form Requirement:** Trading Partner **shall** complete all the information fields in the ANX Subscription Form.

2. **Reachability Requirement:** Trading Partner **shall** turn on the ping function in its ANX Network access router.
   Purpose: Support ANXO and ANX CSP trouble handling.

3. **Route Test Requirement:** Trading Partner **shall** identify in writing and with an accompanying network map one or more test point(s) at the demarcation point behind the ANX Network access router at which the ANXO can run route tests, including trace route tests, between Trading Partner access router and other Trading Partners

   Purpose: To help ensure high service quality in the ANX Network, it is essential that the ANXO be able to confirm the proper use of ANX Routes by ANX CSPs.

4. **No Looping Requirement:** ANX Subscribed Trading Partner **shall** represent to the ANXO that it has configured its ANX Network access router so as to avoid loops with public Internet traffic.

5. **Performance Test Point Origination Requirement:** Trading Partner **shall** identify in writing and with an accompanying network map one or more test point(s) at the demarcation point behind the ANX Network access router, at which the ANXO can temporarily install a performance test tool to test performance to service provider and ANXO test points.

   Purpose: To help ensure high performance in the ANX Network, it is essential that the ANXO be able to do performance testing from the perspective of a Trading Partner.

6. **Performance Test Point Termination Requirement:** Trading Partner **shall** configure its ANX Network access router to act as a permanent termination test point for ANXO performance testing and ANX CSP performance testing.

Purpose: To help ensure high performance in the ANX Network, it is essential that (1) the ANXO be able to do performance testing from the perspective of a Trading Partner, and (2) ANX CSPs be able to comply with their ANX Certification Verification requirements which requires testing up to the ANX Subscribed Trading Partner access router.

7. **IPSec Requirement:** Trading Partner **shall** demonstrate proper configuration of IPSec gateway and/or end system by establishing an IPSec tunnel with the ANXO and exchanging sample data. ANXO shall supply a IPSec Test Script.

   Purpose: This requirement is to help ensure the Trading Partner security complements ANX Network security in support of end-to-end security.

8. **Encryption Key Requirement:** Trading Partner **shall** demonstrate the ability to (1) create all public/private key pairs or demonstrate plans to obtain the keys from an ANX Certificate Authority Service Provider (ANX CASP), and (2) protect the private key from disclosure to entities other than the Trading Partner and an ANX CASP if used to generate the key.

   Note: Once the ANX Subscription Assessment has been passed, public/private keys are generated by the Trading Partner or the Trading Partner's designated agent. The public component of the key-pair shall then be forwarded to the ANX CASP for the creation of an ANX Certificate. The ANX CASP shall then generate an ANX Certificate containing this public key and the user's identity, together with any attributes defined by the Trading Partner and ANX CASP.

   Purpose: This requirement is to help ensure the Trading Partner security complements the ANX Network security in support of end-to-end security.

9. **Trouble Handling Requirement:** Trading Partner **shall** provide ANXO with a documented procedure to contact its ANX CSP for trouble handling.

   Note: This could be a direct contact to the ANX CSP help desk for smaller users or via an existing Trading Partner help desk where such a facility exists.

   Purpose: The purpose of this is to ensure Trading Partner trouble handling complements the ANXO trouble handling process where the ANXO acts as the point of escalation for ANX CSPs.

5.5   ANXO Subscription Report

The ANXO **shall** send the Trading Partner an ANXO Subscription Report consisting of Pass/Fail for each item of the ANX Subscription Form and the ANX Subscription Assessment.

The Trading Partner shall satisfy all these requirements in order to become ANX Subscribed. There shall be an ANXO Contract for Service Provider contractual requirement that obligates an ANX CSP to verify that a Trading Partner is in the ANX Subscribed state before transporting traffic to any destination other than the ANXO via the ANX Network. This verification can be done by the ANX CSP(s) by inspection of the ANXO Directory.

5.6   ANXO Directory

At the end of the ANX Subscription process the ANXO shall list the Trading Partner in the ANXO Directory with its state as ANX Subscribed.

The ANXO Directory shall maintain a database of information regarding each ANX Subscribed Trading Partner. Some of this data shall be supplied by the Trading Partner to the ANXO in the ANX Subscription Form. This database shall include:

1. Help desk contact name and address.

2. Identification of the applications intended to be used by that Trading Partner on the ANX Network.

5.7   ANX Subscription Ongoing Requirements

The ANX Subscription Ongoing Requirements for an ANX Subscribed Trading Partner are as follows:

1. **ANX Subscription Form Requirement:** Trading Partner **shall** complete all changed information fields in the ANX Subscription Form within 10 business days of the change occurring.

2. **Reachability Requirement:** ANX Subscribed Trading Partner **shall** permanently leave on the ping function in its ANX Network access router.

3. **Route Test Requirement:** ANX Subscribed Trading Partner **shall** permit the ANXO to perform route testing from behind the ANX Network access router.   ·

4. **No Looping Requirement:** ANX Subscribed Trading Partner **shall** configure its ANX Network access router so as to avoid loops with public Internet traffic.

5. **No Internet Pass Through Requirement:** ANX Subscribed Trading Partner **shall** not allow public Internet IP traffic to be exchanged with the ANX Network.

6. **IP Access Only Requirement:** ANX Subscribed Trading Partner **shall** use only IP as the network layer access protocol.

7. **No Protocol Interworking Requirement:** ANX Subscribed Trading Partner **shall** not forward non-IP traffic directly to an ANX Subscribed Trading Partner using network layer protocol conversion.

8. **Performance Test Point Origination Requirement:** ANX Subscribed Trading Partner **shall** permit the ANXO to perform installation of a performance test tool and conduct performance tests from behind the ANX Network access router.

9. **Performance Test Point Termination Requirement:** ANX Subscribed Trading Partner **shall** permit the ANXO and its ANX CSP(s) to perform route tests from behind the ANX
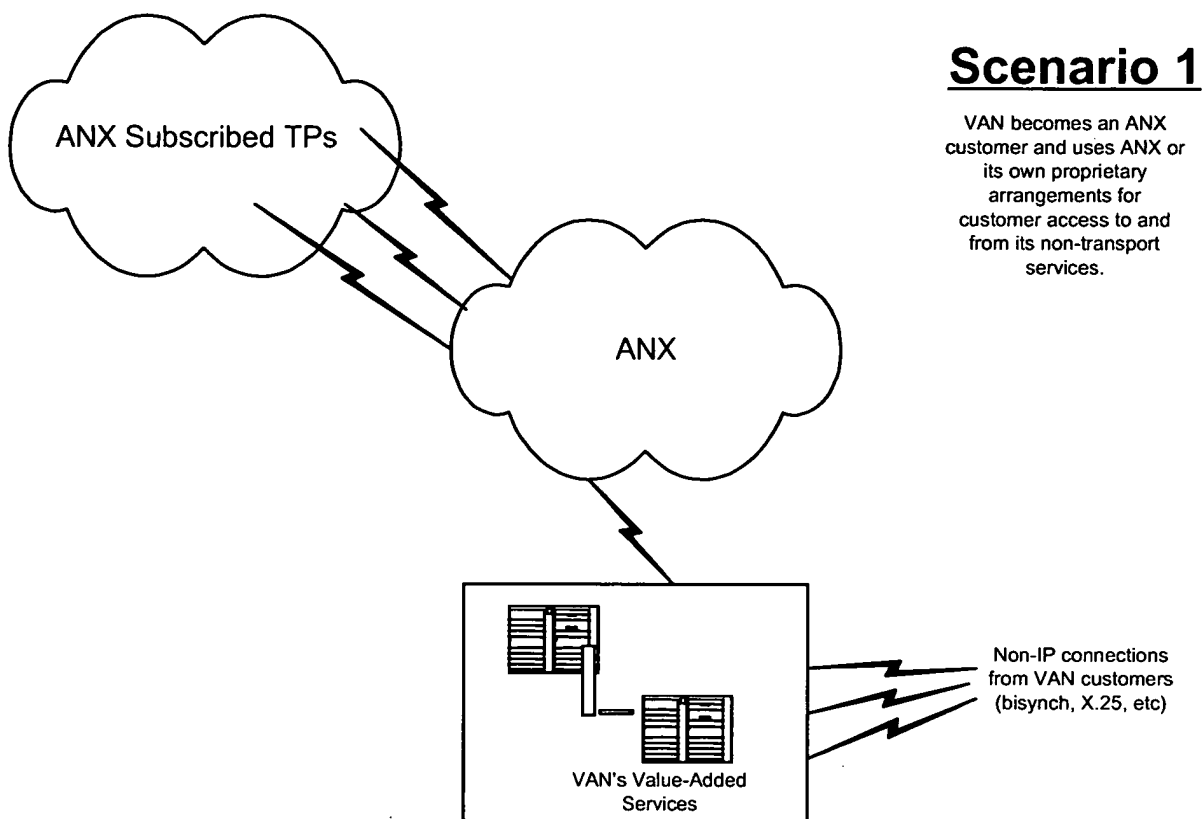
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Network access router.

10. **IPSec Authentication Requirement:** ANX Subscribed Trading Partner **shall** have the Authentication Header functionality turned on for all ANX Traffic.

11. **Encryption Key Requirement:** ANX Subscribed Trading Partner **shall** protect the private key from disclosure to entities other than the Trading Partner and an ANX CASP if used to generate the key.

12. **ANX Certificate Requirement:** ANX Subscribed Trading Partner **shall** use an ANX Certificate only with ANX Traffic to another ANX Subscribed Trading Partner. For example, an ANX Certificate is not to be used over the public Internet.

13. **Trouble Handling Requirement:** ANX Subscribed Trading Partner **shall** first contact its ANX CSP concerning ANX Network troubles. See Section 4.8 below for more context.
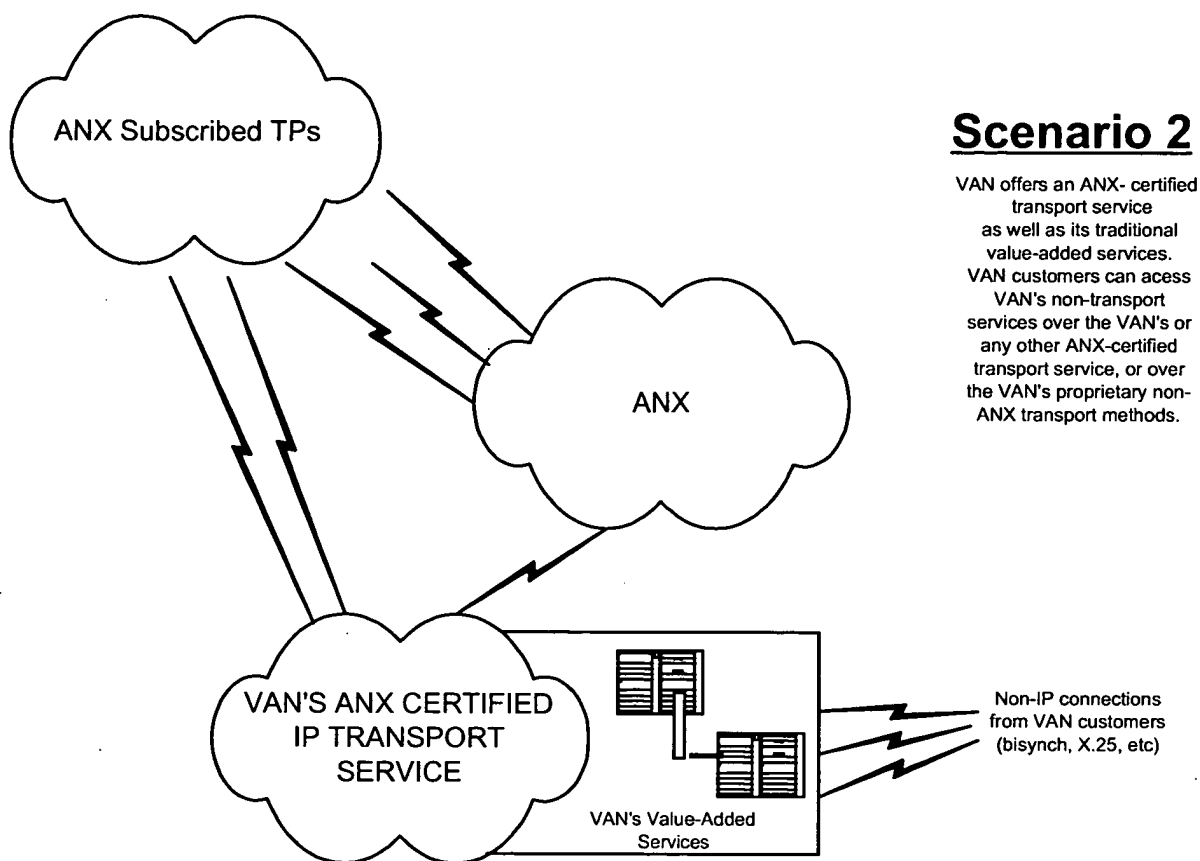
5.7.1 ANX Network Usage Restrictions Note for VANs

1. ANX Network services are based on IP traffic end-to-end. No other network layer protocols are permitted. This principle greatly simplifies performance monitoring and security management issues for the ANX Network.

2. Value-Added Network (VAN) service providers offering content, format conversion, or store-and-forward services to the automotive industry may continue to offer these services over ANX connections or their own proprietary transport arrangements. For ANX Release 1 value-added services will not be certified.

3. VANs may support non-IP access from their customers to their facilities and networks, but may not under any circumstances forward this traffic directly to an ANX-connected trading partner using network layer protocol conversion. Non-IP network layer access to the ANX Network is not permitted.

4. VANs may choose to seek ANX Certification for their network transport services as long as the service to be certified is based entirely on IP. An ANX Certified service shall not offer optional non-IP access and perform network layer protocol conversion.

5. In order to offer pass-through access to the ANX Network, even from a customer that accesses the VAN via IP, the VAN must obtain ANX Certification for this transport service.
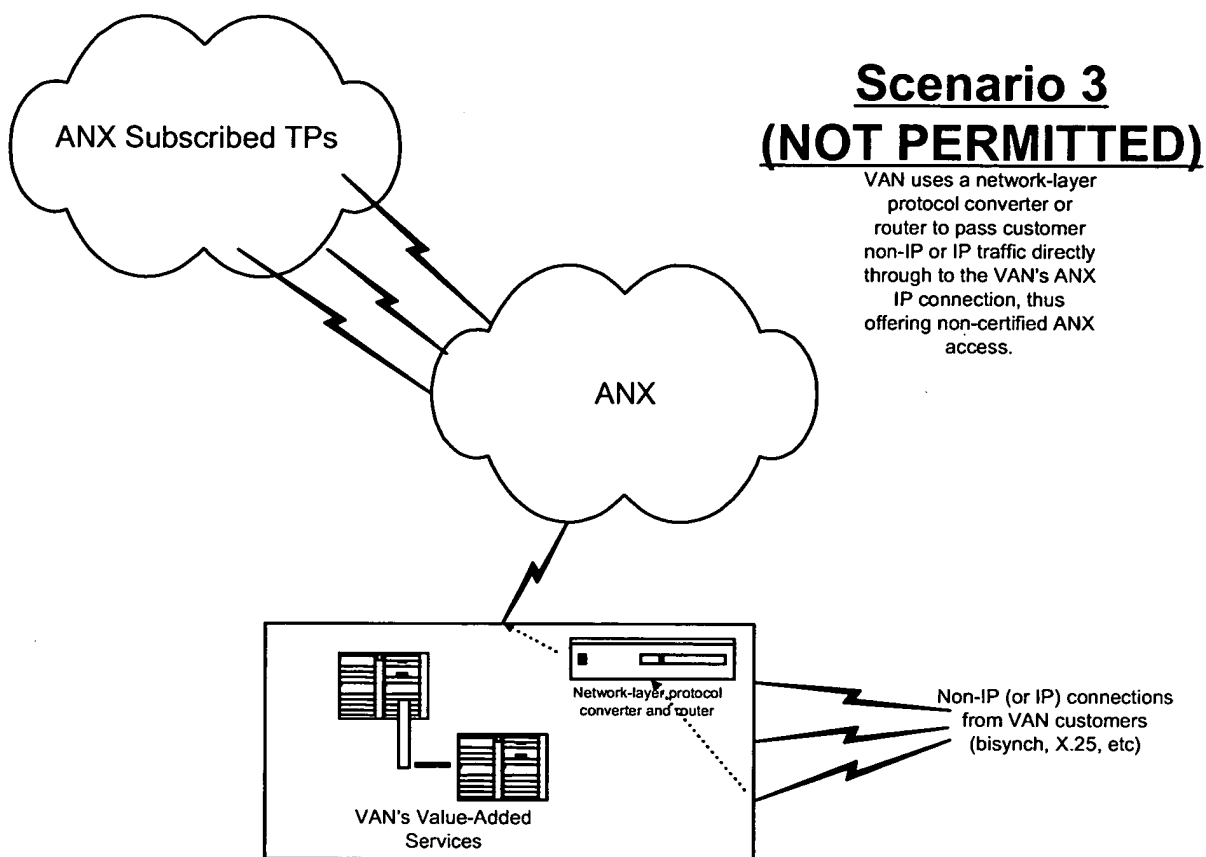
The diagrams that follow illustrate examples of service offerings that are permitted and some that are not.

Scenario 1

VAN becomes an ANX customer and uses ANX or its own proprietary arrangements for customer access to and from its non-transport services.

ANX Subscribed TPs

ANX

VAN's Value-Added Services

Non-IP connections from VAN customers (bisynch, X.25, etc)

Figure 5-1. Scenario 1 for Service Offering Permitted

Scenario 2

VAN offers an ANX- certified transport service as well as its traditional value-added services. VAN customers can acess VAN's non-transport services over the VAN's or any other ANX-certified transport service, or over the VAN's proprietary non-ANX transport methods.

Non-IP connections from VAN customers (bisynch, X.25, etc)

Figure 5-2. Scenario 2 for Service Offering Permitted

Scenario 3
(NOT PERMITTED)

VAN uses a network-layer protocol converter or router to pass customer non-IP or IP traffic directly through to the VAN's ANX IP connection, thus offering non-certified ANX access.

ANX Subscribed TPs

ANX

Network-layer protocol converter and router

VAN's Value-Added Services

Non-IP (or IP) connections from VAN customers (bisynch, X.25, etc)

Figure 5-3. Scenario 3 for Service Offering Not Permitted

Scenario 4
(NOT PERMITTED)

VAN offers an ANX- certified
transport service
as well as its traditional
value-added services.
VAN offers non-IP-to-IP
protocol conversion as an
optional ANX access
method.
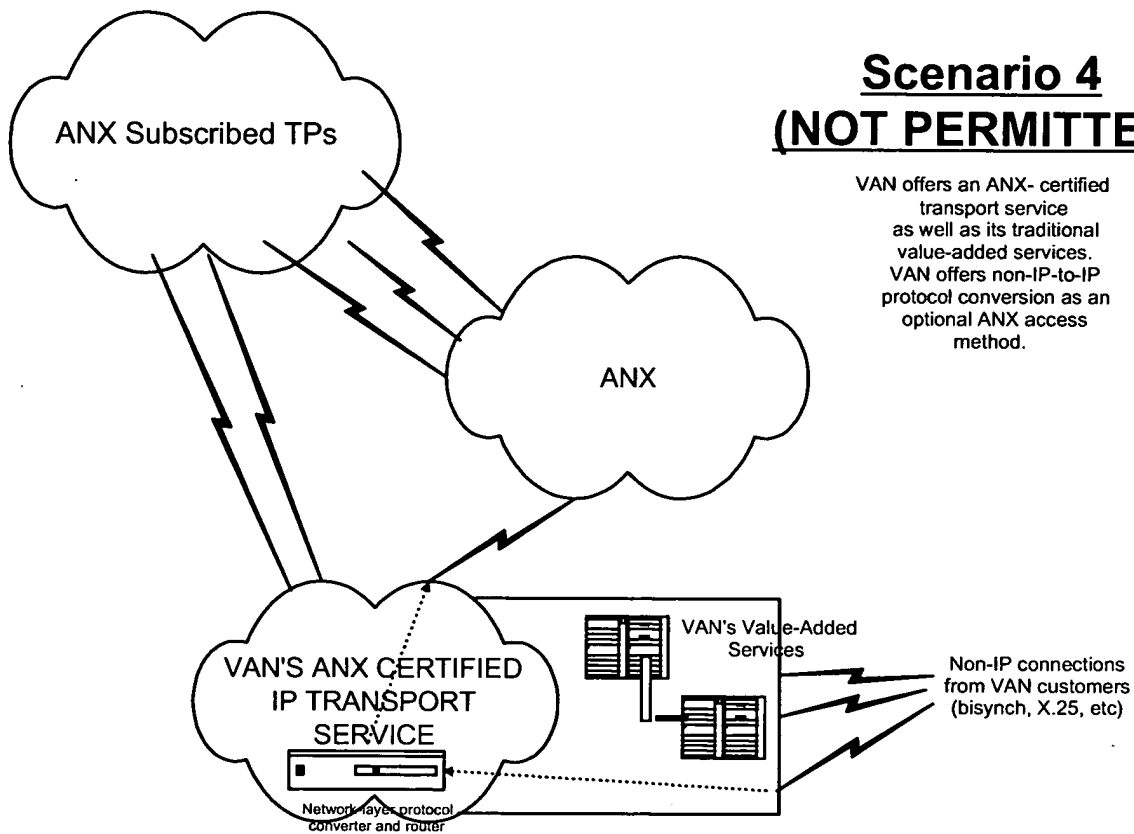
Figure 5-4. Scenario 4 for Service Offering Not Permitted

5.8   Trouble Handling

5.8.1 Trouble Escalation Model

Figure 5-5 below illustrates the escalation sequence for ANX Subscribed Trading Partner related and service provider related problems.

For example, consider a trouble detected by an ANX Subscribed Trading Partner. The steps shall be as follows:

1. It is expected that the ANX Subscribed Trading Partner shall determine if it is a Trading Partner to Trading Partner trouble, in which case it is to be handled outside the scope of ANX Network, or a ANX Subscribed Trading Partner to ANX Network trouble.

2. If it is an ANX Subscribed Trading Partner to ANX Network trouble and if resolution cannot be obtained within the ANX Subscribed Trading Partner, then the trouble shall be escalated with the relevant data to the ANX CSP, following an arrow numbered 2 in the Figure 5-5. An ANX Subscribed Trading Partner shall escalate to its ANX CSP rather than directly to the ANXO. When an ANX Subscribed Trading Partner calls the ANXO, as illustrated by arrows numbered 5 in Figure 5-5, the ANXO shall notify the ANX CSP and work with the ANX CSP as if the trouble had been reported by the ANX CSP.

3. The ANX Subscribed Trading Partner and ANX CSP groups shall try to resolve the problem.

If the trouble involves other ANX CSP/ANX CEPOs the ANX CSP shall coordinate with the involved ANX CSP/ANX CEPOs, following arrows numbered 3 in the Figure 5-5.

4. If all the involved ANX CSP/ANX CEPOs cannot resolve the trouble then, and only then, the ANX CSP to whom the ANX Subscribed Trading Partner subscribes shall escalate it to the ANXO, along with the trouble ticket with all the trouble history to date. Each other ANX CSP/CEPO involved shall also submit trouble ticket information to the ANXO. If this information is not made available, the ANXO shall request that it be provided. This follows arrows numbered 4 in Figure 5-5.

5. The ANXO shall initiate the ANXO Trouble Handling process for the trouble as described in [Part 6, Ref #1].
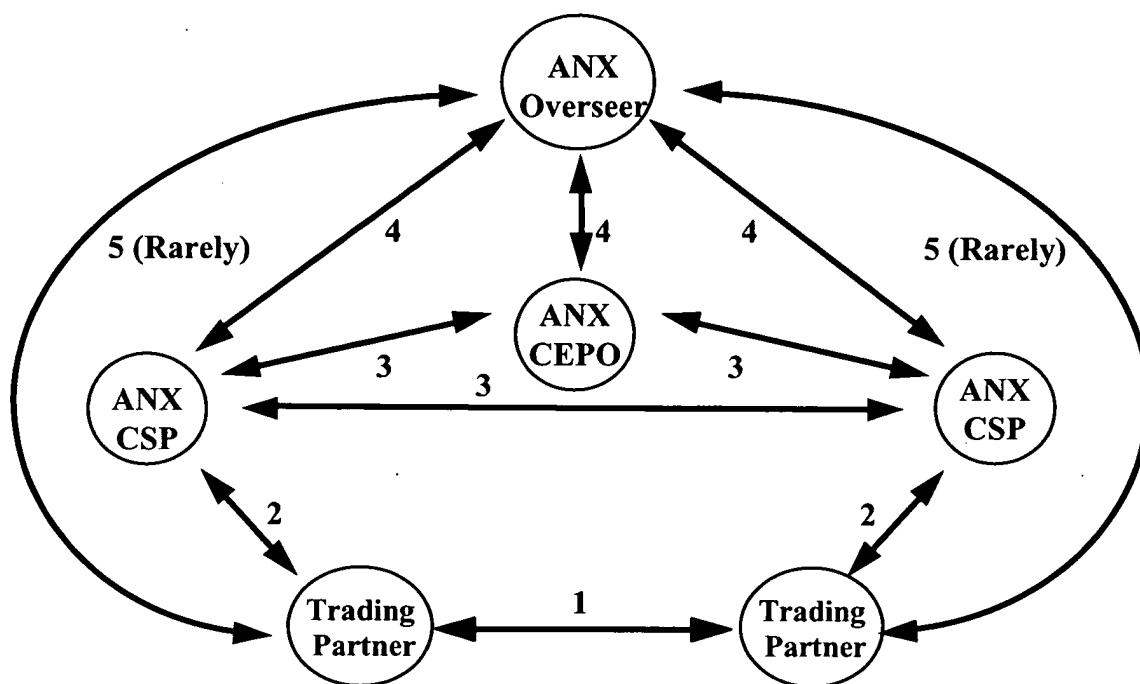
Figure 5-5. ANX Trouble Escalation Model

5.   ANXO Customer Care Help Desk

Calls to the ANXO Customer Care Help Desk can be generated from Trading Partners in any state in the ANX Registration and Subscription process for Trading Partners. The sizing of the ANXO Help Desk expects that the hierarchy of interactions identified in "Trouble Handling" Section 4.8 above be followed for trouble handling.

Calls to the ANXO Customer Care Help Desk from Trading Partners can be categorized into two types:

1. Information requests: These are requests for information or answers to data oriented questions. For example, a request could be made for an ANXO Service Provisioning Package for Trading Partner. The ANXO Help Desk shall respond to informational requests on an 9:00a.m.-5:00p.m. EST Monday through Friday basis, except for Public U.S. Holidays.

2. Account inquiries: These inquiries are from companies with valid ANXO Contract for Trading Partner. The calls might concern billing or other issues that are specific to the contractual relationship between the ANXO and the Trading Partner. ANXO help desk shall respond to account inquiries on an 8:00a.m.-8:00p.m. EST Monday through Friday basis, except for Public Holidays

Further service detail is given in [Part 6, Ref #4].

PART 4

ANX Overseer Services

Part 4 - ANX Overseer Services

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List of Tables

1. ANX Certification Services to ISPs and EPOs

1.1 Service Level.

ANXO staff **shall** work Monday through Friday, except for Public Holidays, to provide ANX Certification Services other than ANX Trouble Handling Services.

ANXO **shall** process each submission, for ANX Registration, ANX Certification Application, and ANX Certification Assessment, received from service providers on a first-come first-served basis.

ANXO **shall** send notification of *estimated* scheduled start date within ten (10) business days of receipt of the submission, for each of ANX Registration, ANX Certification Application, and ANX Certification Assessment.

ANXO **shall** use reasonable commercial efforts to meet the number of days for each step in the process as described in [Part 6, Ref. #1].

1.2 ANXO Contracting.

ANXO **shall** operate the ANXO Contracting process. See [Part 6, Ref. #1], Section 2 for a description of this process.

1.3 ANX Registration Service.

ANXO **shall** operate an ANX Registration Service. See [Part 6, Ref. #1], Section 3 for a description of the process for this service.

As part of this service, ANXO **shall** send an ANX Registration notification to the ISP/EPO within ten (10) business days from the time the ANXO begins work on the ANX Registration.

1.4 ANX Certification Application Service.

ANXO **shall** operate an ANX Certification Application Service whereby an ISP/EPO shall be analyzed by the ANXO to determine compliance with the ANX Certification Application Criteria in [Part 6, Ref. #2]. See [Part 6, Ref. #1], Section 4 for a description of the process for this service.

As part of this service, ANXO **shall** send an ANX Certification Application Report to the ISP/EPO with status Pass or Fail within twenty (20) business days from the time the ANXO begins work on the ANX Certification Application.

1.5   ANX Certification Assessment Service.

ANXO **shall** operate an ANX Certification Assessment Service whereby an ISP/EPO **shall** be analyzed by the ANXO to determine compliance with the ANX Certification Assessment Criteria specified in [Part 6, Ref. #2]. See [Part 6, Ref. #1], Section 5 for a description of the process for this service.

As part of this service, ANXO **shall** send a First, Second, and Third ANX Certification Assessment Report to the ISP/EPO by thirty (30) business days, after the number of business days calculated by the algorithm stated in [Part 6, Ref. #1], and by one hundred and twenty (120) business days respectively from the time the ANXO begins work on Business Day One. ANXO **shall** send a Fourth ANX Certification Assessment Report to the ISP/EPO at the end of analysis of all the ANX Certification Assessment Criteria.

For a service provider that has met the prerequisites for being awarded ANX Certification, the ANXO **shall** then provide the ANX CSP/ANX CEPO with a Letter of Approval and a Certificate of ANX Certification as elaborated in [Part 6, Ref. #1], Section 5.2.

1.6   ANX Certification Verification Service.

1.6.1   Monitoring Service.

ANXO **shall** operate an ANX Certification Verification Service whereby an ISP/EPO **shall** be analyzed by the ANXO to determine compliance with the ANX Certification Verification Criteria specified in [Part 6, Ref. #2]. See [Part 6, Ref. #1], Section 6 for a description of the process of ANXO monitoring to evaluate submissions from service providers and to audit service providers.

1.6.2   Trouble Handling Service.

ANXO **shall** operate an ANX Trouble Handling Service. See [Part 6, Ref. #1], Section 7 and this document [Part 6, Ref. #4], Section 4.2 for a description of the process for this service.

As part of this service, for any ANX CSP/ANX CEPO failure to met any ANX Certification Verification Criterion the ANXO **shall** immediately initiate the ANXO Trouble Handling process. ANXO **shall** notify an ANX CSP/ANX CEPO of a Trouble Timer initiated for that ANX CSP/ANX CEPO within one (1) business day of initiating the Trouble Timer.

With respect to escalation to the ANXO when the ANX CSP/ANX CEPO fails to resolve a trouble after implementing the other procedures in its Trouble Escalation Policy as defined in [Part 6, Ref. #2], the ANXO **shall** function as a problem resolution focal point, aiding in the determination of the problem, isolation of problems, and in the definition of action plans for resolutions.

ANXO **shall** operate an Outage Notification Bulletin Board for ANX CSPs/ANX CEPOs. This is described in [Part 6, Ref. #2], Section 5.

1.6.3 ANX Domain Name Registry Service

ANXO **shall** operate an ANX Domain Name Registry Service. This service is described in the remainder of this Section 1.6.3.

1.6.3.1 Overview

This registry contains the ANX domain name of each ANX Trading Partner along with the IP addresses of the ANX Trading Partners name-servers. ANX Trading Partners provide their Domain Name information to the ANXO when they submit the ANX Subscription Form for Trading Partner. This information is placed in a configuration file that is downloaded from the ANXO by the ANX CSPs and also those ANX Trading Partners that want high reliability name resolution functionality. This file is downloaded by ANX CSPs on a daily basis to ensure that the most up to date domain name information is available to ANX Trading Partners.

The DNS architecture in the ANX Network uses the Internet to resolve all host-names, Internet and ANX Network. This allows ANX Hosts to also resolve Internet host-names. So if an ANX Host is connected to both the ANX Network and the Internet, name resolution for both networks will work successfully. The same holds true for Internet hosts that need to reach servers that are located on both the ANX Network and the Internet.

The ANXO also provides a configuration file to ANX CSPs and Trading Partners to increase the reliability of name resolution. This configuration file will allow name-servers to continue to provide Trading Partners with ANX name resolution even when the Internet Root name-servers are unreachable. However, only ANX domains will be resolvable, all other Internet hosts will not be resolvable during this period of Internet inaccessibility.

The configuration file provided by the ANXO contains each Trading Partners domain as a stub. A name-server configured with stubs is very similar to being a secondary name-server to every Trading Partners domain, except significantly less information is transferred between the name-servers. This allows each Trading Partner to resolve other Trading Partners hosts on the ANX Network without relying on the Internet. The format of the stub command is:

stub <domain> <ip address of name-servers for this domain> <file to hold stub information>

Every Trading Partner that has registered their domain with the ANXO Naming Registry will have a line in the configuration file based upon the above format.

1.6.3.2   Service Level

1.6.3.2.1   Domain Name Registry

The ANXO **shall** administer an ANX Domain Name Registry for the ANX Network. A configuration file based on the ANX Domain Name Registry **shall** be made available to ANX CSPs and ANX Trading Partners for download. The ANXO **shall** operate a server that will have this configuration file available.

1.6.3.2.2   DNS Information Update

Additions, deletions, or changes to ANX Subscribed Trading Partner Domain Name information **shall** be processed and entered into the ANX Domain Name Registry within twenty four (24) hours after the ANX Trading Partner Subscription Form for an ANX Subscribed Trading Partner has been received by the ANXO.

1.6.3.2.3   DNS Configuration File Availability

ANX DNS configuration file **shall** be available for download by ANX CSPs and ANX Subscribed Trading Partners at least 97.5% of the time (all but 4.2 hours per week, measured over a rolling three month period).

1.6.4   ANX Routing Registry Service

ANXO **shall** operate an ANX Routing Registry Service. The ANX Routing Registry contains routing information provided by ANX CSPs for ANX Subscribed Trading Partners. The description of the ANX CSP interfacing process with the ANX Routing Registry is defined in [Part 6, Ref. #2], Section 10.3. Otherwise, this service is described in the remainder of this Section 1.6.4.

1.6.4.1   Service Level

1.6.4.1.1   ANX Routing Registry Services

ANXO **shall** perform the following:

1. Contact the ANX CSP to help them register necessary information in the ANX Routing Registry.

2. Check for correctness of the Autonomous System (AS) number and IP address prefixes submitted by the ANX CSP to be registered in the ANX Routing Registry from the American Registry for Internet Numbers (ARIN).

3. Notify participating ANX CSPs of the new member.

4. Update participating ANX CSPs' policies as registered in the ANX Routing Registry to allow them to automatically receive routes from the new ANX CSP.

An ANX CSP is given the option of having ANXO perform default ANX Peering Metrics policy update in the ANX Routing Registry or managing its own policy update in ANX Routing Registry. The choice should be made known to the ANXO when entering the ANX Peering process.

1.6.4.2　　　Routing Registry Operation

The ANXO **shall** accept objects from all ANX CSPs via electronic mail and, if the objects conform to the correct syntax and contain authentic information, the ANXO **shall** enter the objects into the ANX Routing Registry.

1.6.4.3　　　Routing Registry Information Update

Additions, deletions, or changes to the ANX Routing Registry information within objects accepted from an ANX CSP **shall** be processed and entered into the ANX Routing Registry within 24 hours after the request has been received by the ANXO from an ANX CSP.

1.6.4.4　　　Routing Registry Availability

ANX Routing Registry **shall** be available at least 97.5% of the time (all but 4.2 hours per week, measured over a rolling three month period).

1.6.4.5　　　Regulation of ANX Peering Metrics

The following procedures describe how the ANX Peering Metrics will be regulated by the ANXO.

1. ANX Peering Metrics shall be enforced by the ANXO. The ANXO shall monitor ANX CSPs' usage of the ANX Routing Registry and ANX Route Server and shall assess ANX CSPs' compliance with ANX Peering Metrics via tools between ANX CSP Test Points and /or Trading Partner locations. ANX CSPs will support traceroute to enable tests between ANX CSP Test Points and/or Trading Partner locations.

2. The ANXO shall resolve problems reported by ANX CSPs, ANX Subscribed Trading Partners, or ANX CEPOs with any ANX CSP's compliance with ANX Peering Metrics.

3. The ANXO shall maintain a list of authorized representatives (a primary and one or more alternates) from each ANX CSP. The authorized representative(s) will represent the policies of the participating organization at the ANX Peering Metrics meetings.

4. Special meetings may be held at any time upon the request by the ANXO or a majority of the

ANX CSPs' authorized representatives. All requests for special meetings will be arbitrated via email exchange with the ANXO.

5. ANX Peering Metrics meetings will be accomplished via audio conference calls, if possible.

6. Changes in the ANX Peering Metrics will be instigated by contacting the ANXO.

1.7   ANX Certification Probation Service.

ANXO **shall** operate an ANX Certification Probation Service. See [Part 6, Ref. #1], Section 8 for a description of the process for this service.

As part of this service, ANXO **shall** list the state of the ANX CSP/ANX CEPO as ANX Certification Probation in the public portion of ANXO Directory with ANX Certification Probation Timer expiration date and summary of cause for ANX Certification Probation including whether the cause concerns not meeting a Tripwire Metric Criterion.

As part of this service, within five (5) business days ANXO **shall** notify the ANX CSP/ANX CEPO in writing by Postal Mail with receipt confirmation of their ANX Certification Probation state.

As part of this service, within five (5) business days ANXO **shall** notify ANX Subscribed Trading Partners of the ANX Certification Probation state of the ANX CSP with which they are subscribed.

1.8   ANX Certification Revocation Service.

ANXO **shall** operate an ANX Certification Revocation Service. See [Part 6, Ref. #1], Section 9 for a description of the process for this service.

As part of this service, ANXO **shall** list the state of the ANX CSP/ANX CEPO as ANX Certification Revoked in the public portion of ANXO Directory with ANX Certification Revocation Timer expiration date and summary of cause for ANX Certification Revocation.

As part of this service, within five (5) business days ANXO **shall** notify the ANX CSP/ANX CEPO in writing by Postal Mail with receipt confirmation of their ANX Certification Revocation state.

As part of this service, within five (5) business days ANXO **shall** notify ANX Subscribed Trading Partners of the ANX Certification Revocation state of the ANX CSP with which they are subscribed.

1.9   ANX ReCertification Service.

ANXO **shall** operate an ANX ReCertification Service. See [Part 6, Ref. #1], Section 10 for a description of the process for this service.

As part of this service, at least thirty (30) business days in advance, the ANXO **shall** notify by Postal

Mail with receipt confirmation each ANX CSP/ANX CEPO as to the calendar date that will initiate the period of ANX ReCertification. On that date, the ANXO **shall** start and monitor a ANX ReCertification Timer of sixty (60) calendar days.

1.10 Dispute Resolution Service.

ANXO **shall** operate a Dispute Resolution Service. See [Part 6, Ref. #1], Section 11 for a description of the process for this service.

As part of this service, in twenty five (25) U.S. business days from date of Appeal, the ANXO **shall** review the Appeal of an ISP/EPO or ANX CSP/ANX CEPO; either (1) reconfirm the decision, or (2) change the decision; and communicate the outcome in writing to the company making the Appeal and to the AIAG, or AIAG designated body.

As part of this service, and for fee, the ANXO **shall** assist in resolving business disputes concerning ANX CSP and ANX CEPO interconnection agreements.

2. ANX Registration and Subscription Services to Trading Partners

2.1 Service Level.

ANXO staff **shall** work Monday through Friday, except for Public Holidays, to provide ANX Registration and Subscription Services.

The ANXO **shall** process all submissions received from trading partners in connection with the ANX Registration and Subscription process on a first-come first-served basis.

ANXO **shall** use reasonable commercial efforts to meet the number of days for each step in the process as described in [Part 6, Ref. #3].

2.2 ANX Sponsorship.

ANXO **shall** support an ANX Sponsorship process. See [Part 6, Ref. #3], Section 2 for a description of this process.

As part of this process, ANXO **shall** purge a sponsorship record from the sponsored TP database after six months of no response to ANXO inquiries to that Trading Partner.

2.3 ANXO Contracting.

ANXO **shall** operate an ANXO Contracting process. See [Part 6, Ref. #3], Section 3 for a description of this process.

As part of this process, ANXO **shall** send an ANX Service Provisioning Package for Trading Partners to a Trading Partner listed in the sponsored TP data base within five (5) business days of receiving a request from that Trading Partner.

2.4 ANX Registration Service.

ANXO **shall** operate an ANX Registration Service. See [Part 6, Ref. #3], Section 4 for a description of the process for this service.

As part of this service, ANXO **shall** assign an ANXO Account Number to a Trading Partner within five (5) business days of satisfactory completion of the ANX Registration Form by that Trading Partner.

2.5 ANX Subscription Service.

ANXO **shall** operate an ANX Subscription Service. See [Part 6, Ref. #3], Section 5 for a description

of the process for this service.

As part of this service, ANXO **shall** provide an IPSec test point and test script to enable Trading Partner IPSec tests as part of ANX Subscription Assessment with the ANXO.

As part of this service, ANXO **shall** deliver to a Trading Partner the ANXO Subscription Report within five (5) business days of successful completion of ANX Subscription Form and ANX Subscription Assessment by that Trading Partner.

As part of this service, ANXO **shall** list a Trading Partner state as ANX Subscribed in the ANXO Directory within five (5) business days of successful completion of ANX Subscription Form and ANX Subscription Assessment by that Trading Partner.

3.   ANXO Services To Certificate Authority Service Providers

3.1   Introduction.

The ANX Certificate Authority Service is not an ANXO function. It is a function for which the ANXO has arranged and for which the ANX Certificate Authority Service Provider (ANX CASP) has independent responsibility.

3.2   ANXO Services.

ANXO **shall** operate an ANX Certification Service for ANX Certificate Authority Service Providers. This service is described in [Part 6, Ref. #5].

As part of this service, the ANXO **shall** authorize each issuance by an ANX CASP of an ANX Certificate to an ANX Subscribed TP.

As part of this service, the ANXO **shall** provide the list of IP addresses assigned to an ANX Subscribed TP to the ANX CASP that issues ANX Certificates to that ANX Subscribed TP.

As part of this service, the ANXO **shall** authorize revocation of all ANX Certificates issued to any TP for which the ANXO Contract for Trading Partner has terminated.

4. ANXO Help Desks

4.1 ANXO Customer Care Help Desk

The ANXO **shall** establish a customer care help desk.

Calls to the ANXO Customer Care Help Desk can be categorized into two types:

1. Information requests: An example is a request for an ANXO Service Provisioning Package for Trading Partner.

    ANXO Customer Care Help Desk **shall** respond to informational requests on an 9:00a.m.-5:00p.m. EST Monday through Friday basis, except for Public Holidays.

2. Account inquiries: These inquiries are accepted only from companies with a valid ANXO Contract. The calls might concerns billing, contractual matters, or other issues that are specific to the contract based relationship between the ANXO and the service provider or Trading Partner.

    ANXO Customer Care Help Desk shall respond to account inquiries on an 8:00a.m.-8:00p.m. EST Monday through Friday basis, except for Public Holidays.

For these two types of call, the ANXO Customer Care Help Desk **shall** route the call to a person with the required skills and access to the required data to handle the call effectively.

Other types of calls from Trading Partners will be referred to sources of help other than the ANXO. As examples, (1) for a Trading Partner call about an ANX Network trouble, the ANXO will refer the Trading Partner to the ANX CSP to which that Trading Partner subscribes, and (2) for a Trading Partner call about an IPSec trouble, the ANXO will refer the Trading Partner to an IPSec product supplier or to any IPSec help desk service that may exist.

The ANXO Customer Care Help Desk for ANX Release 1 **shall** address information requests only in English.

4.2 ANXO Trouble Handling Help Desk

The ANXO **shall** establish a trouble handling help desk.

Trouble reports: in general, these inquiries are accepted only from ANX CSPs, ANX CEPOs, and

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ANX CASPs concerning ANX Network troubles. The sizing of the ANXO Trouble Handling Help Desk expects that the hierarchy of interactions identified in "Trouble Handling" Section of [Part 6, Ref. #1] be followed for trouble handling; as part of this, calls from ANX Subscribed Trading Partners should be rare events occurring as "a last resort" when that Trading Partner has exhausted trouble resolution procedures with its ANX CSP. These calls are processed by the ANXO as described in [Part 6, Ref. #1].

Availability of the ANXO help desk for troubles **shall** be 24 hour x 7 day x 52 week. A record of each call **shall** be maintained in the ANXO Documentation Repository.

The ANXO Trouble Handling Help Desk **shall** route the call to a person with the required skills and access to the required data to handle the call effectively.

The ANXO Trouble Handling Help Desk for ANX Release 1 **shall** address trouble reports only in English.

5.   ANXO Reporting

5.1   ANXO Directory and Additional Web Services

The ANXO Directory **shall** provide state information for the ISPs/EPOs as they proceed through the process steps required for ANX Certification. The ANXO Directory divides the information based on (i) publicly visible information and (ii) information accessible only over the ANX Network. See [Part 6, Ref. #1], Section 1.5 for an elaboration.

A publicly accessible Web page (*http://www.anxo.com*), in English, **shall** be provided by the ANXO for frequently asked questions concerning the stages of the ANX Certification process.

The ANXO Directory **shall** provide state information for the Trading Partners as they proceed through the process steps required for ANX Registration and Subscription. The ANXO Directory divides the information based on (i) publicly visible information and (ii) information accessible only over the ANX Network. See [Part 6, Ref. #3], Section 1.4 for an elaboration.

A publicly accessible Web page (*http://www.anxo.com*), in English, **shall** be provided by the ANXO for frequently asked questions concerning the stages of the ANX Registration and Subscription process.

ANXO **shall** include additional data on the public ANXO web site (*http://www.anxo.com*), including:

- ANXO Help Desk telephone number(s), and facsimile number(s).

- ANX Registration Form for Trading Partner.

- ANX Subscription Form for Trading Partner.

- List of Authorizing Trading Partners and contact information for them.

- Links to ANX CSP/ANX CEPO company web sites.

- Links to International Computer Security Association (ICSA) web site and ICSA-certified IPSec vendor web sites.

- Links to ANX Certificate Authority Service Provider web sites.

- Information on ANX Service-related AIAG training courses for Trading Partners and Systems Integrators.

- Corrections to AIAG TEL-2, Revision 1 document [Part 6; Ref. #1,2,3,4,5,6].

ANXO **shall** include additional Trading Partner data on the ANX Network accessible ANXO web site within ten (10) business days of receipt. This data is expected to include:

- ANX Subscribed Trading Partner help desk contact information.

- ANX Subscribed Trading Partner listing of ANX Network accessible applications.

5.2   ANXO Reporting of Service Quality

ANX Certification Processes	ANXO Reporting To:		
	ISP/EPO, ANX CSP/CEPO	ANX Subscribed TP	Public
ANX Certification Application	Yes: ANX Certification Application Report [Part 6, Ref. #1].	No.	No.
ANX Certification Assessment	Yes: First, Second, Third, and Fourth ANX Certification Assessment Reports [Part 6, Ref. #1].	Yes: Via public ANXO Directory listing of ISP/EPO status as ANX Certification Assessment Pending [Part 6, Ref. #1].	Yes: Via public ANXO Directory listing of ISP/EPO status as ANX Certification Assessment Pending [Part 6, Ref. #1].
ANX Certification Verification	Yes: Periodic ANX Certification Verification Reports [Part 6, Ref. #1] - see Note 1.	Yes: Quarterly postal mail of Trading Partner Report - see Note 2.	Yes: Via public ANXO Directory listing of ISP/EPO status [Part 6, Ref. #1].
ANX Trouble Handling	Yes: Outage Notification Bulletin Board.	Possibly, depending on ANX TP-selected options: Via ANX CSP-Optional Certified Service Trouble Ticket Electronic Access Service [Part 6, Ref. #2].	No.
ANX Certification Probation	Yes: Written notification by Postal Mail sent within 5 business days [Part 6, Ref. #1].	Yes: (1) Written notification by Postal Mail sent within 5 business days, (2) Via public ANXO Directory listing of ISP/EPO status [Part 6, Ref. #1].	Yes: Via public ANXO Directory listing of ISP/EPO status [Part 6, Ref. #1].
ANX Certification Revocation	Yes: Written notification by Postal Mail sent within 5 business days [Part 6, Ref. #1].	Yes: (1) Written notification by Postal Mail sent within 5 business days, (2) Via ANXO Directory for ANX Participants listing of ISP/EPO status [Part 6, Ref. #1].	Yes: Via public ANXO Directory listing of ISP/EPO status [Part 6, Ref. #1].
Recertification	Sent 30 business days advance notice.	Sent 30 business days advance notice.	Yes: 30 business days advance notice via public ANXO web site.

Table 5-1. ANXO Reporting Regarding ANX Certification Processes for ANX CSPs/ANX CEPOs

Note 1: ANXO periodic reports to ANX CSP/ANX CEPOs. This will happen following the ANXO analysis of Certification Verification data collected from Periodic Certification Verification or Certification Verification Audit measurements. The ANXO **shall** use methods such that the data reporting is statistically significant, impartially presented, unambiguous, and network operationally relevant.

Note 2: ANXO reports to ANX Subscribed TPs on the service quality of the ANX CSP to which that TP subscribes. For an ANX CSP in the ANX Certified state, the scope of the report **shall** be a confirmation that each ANX Certification Verification Criterion is being met; for an ANX CSP in the ANX Certification Probation or the ANX Certification Revocation state, the cause of the ANX CSP being in that state **shall** be explained.

5.3 Allocation of Data and Reports to Category of Confidential Information

Category 1:

- ANX Registration notification.

- ANX Certification Application data and Report.

- ANX Certification Assessment data and Report.

- ANX Certification Verification data and Report.

Category 2:

- None.

Category 3:

- None.

Category 4:

- ANX Subscribed Trading Partner Report.

- ANXO public and ANX Network accessible web site content.

6.   ANXO Documentation Handling

6.1   Documentation Archive

The ANXO **shall** archive the following information for three (3) years:

- ANX Certification documentation.

- ANXO Trouble Handling Help Desk interactions.

- ANXO Trouble Tickets.

This documentation archive is important to support the Dispute Resolution Process. The dispute process, and any arbitration, is expected to rely on accurate and readily available ANXO archived information.

7. ANXO Billing

The ANXO **shall** bill for the ANXO Contract for Service Providers Fee Schedule fees. These fees are described in [Part 6, Ref. #1], Section 2.3.

The ANXO **shall** bill for the ANXO Contract for Trading Partners Fee Schedule fees. These fees are described in [Part 6, Ref. #3], Section 3.3.

The ANXO **shall** bill for the ANX Certification Application and Assessment Fee for ANX CASPs and the ANX Certification Verification Fee for ANX CASPs. These fees are described in [Part 6, Ref. #5], Section 2.

ANXO billing **shall** include invoicing and collections.

ANXO billing **shall** take place in advance of relevant ANXO processes to be rendered, for one time and periodic fees. For all other fees ANXO **shall** bill in arrears.

8. ANX Technical Suggestions Process for ANX Release 2

The ANXO **shall** define ANX Release 2 requirements. In doing this, the ANXO **shall** take into account suggestions from ANX Participants. See the ANX Network accessible ANXO web site for details of the process.

9. To AIAG

All ANXO Services in this document [Part 6, Ref. #4] are provided under contract to the Automotive Industry Action Group (AIAG).

PART 5

ANX Certificate Authority Service Provider Requirements

Part 5 - ANX Certificate Authority Service Provider Requirements

Table of Contents

1. ANX Certificate Authority Service Provider Requirements

1.1 Scope of the ANX Certificate Authority Service Provider Requirements

The ANX Certificate Authority Service Provider Requirements define the necessary attributes and activities of an entity that will provide ANX Certificates to ANX Subscribed Trading Partners.

1.2 Overview of ANX Certificate Authority Service Provider Service

An ANX Certificate Authority Service Provider (CASP) provides ANX Certificates in support of the ANX security infrastructure. ANX Certificates will initially be used for authenticating IPSec connections among ANX Trading Partners. ANX Trading Partners IPSec hosts and gateways will use these certificates to authenticate host and gateways that they communicate with. For more information on digital certificates and Public Key Infrastructures see Appendix A in this document. The ANX Certificate Authority service is primarily made up of four components:

1. ANX Certificate Manufacturing Authority – An entity that signs and publishes digital certificates for use in the ANX Network.

2. ANX Registration Authority (RA) – An entity that authenticates and authorizes ANX Subscribed Trading Partners to receive ANX Certificates.

3. ANX Repository – An entity where ANX Certificates and ANX Certificate Revocation Lists (CRL) are stored.

4. ANX CASP Certificate Practice Statement – This document lists in detail the procedures, policies, uses and rights associated with an ANX CASP. See [Part 6, Ref #30] and references therein for more information on this statement.

An ANX CASP must implement all of the items above. The following sections will provide more detail about the specific requirements that an ANX CASP must meet when implementing the above items.

2. Requirements for ANX Certification Application and ANX Certification Assessment Process for CASP

The process for a CASP to become and remain an ANX CASP is as follows:

1. CASP follows the ANX Certification Application and Assessment process for CASPs

2. If the CASP meets all the requirements for ANX Certification Application and Assessment then the CASP pays the first monthly ANX Certification Verification Fee for CASPs

3. The ANXO grants to the CASP a Certificate; the CASP has become an ANX CASP for ANX Release 1 in North America.

4. In order to remain certified the ANX CASP must meet the requirements for ANX Certification Verification for ANX CASPs.

In order for a company to apply to, and being assessed to become an ANX CASP the requirements listed in the following sections have to be met.

A **requirement** is defined to be a feature or function that is necessary to be satisfied by a CASP or ANX CASP. A requirement contains the word "shall" and is marked with an "R" in the margin. Requirements are organized in **Numbered Requirement Packages**. The numbering format is as follows (x corresponds to a main section number: and y denotes a sequence number):

1. [Rx-y: CertApp] for ANX Certification Application requirements

2. [Rx-y: CertAssVer] for ANX Certification Assessment and Verification requirements

A summary of the requirements follows at the end of the numbered requirement packages.

2.1 ANX Certification Application Requirements for CASPs

[R2-1.: CertApp]   ANX Certification Application and Assessment Form

R   A CASP **shall** complete the ANX Certification Application and Assessment Form for CASPs and return it to the ANXO.

[R2-2.: CertApp]   ANX Certification Application and Assessment Fee

R   The CASP **shall** pay the ANX Certification Application and Assessment Fee to the ANXO.

[R2-3.: CertApp]   Company Information

R   The ANX CASP Applicant **shall** provide all of the following company information as part of the ANX Certification Application requirements:

1.   Name and address of the company/ subsidiary (and the name and address of the parent company if it is a subsidiary) that will provide Certificate Authority Service.

2.   ANXO Service Contract number.

3.   Date and state of incorporation.

4.   Corporate credit rating of the ANX CASP Applicant or parent (if ANX Applicant is a subsidiary)

5.   Information on structure and control of company (public, private (partnership, proprietorship), subsidiary, joint venture or other association of service providers, or other).

6.   Major shareholders (if subsidiary of another company, please provide name and address of parent company).

7.   Information on its main line of business. The ANX CASP Applicant **shall** elaborate on its main line of business. ·

8.   Number of years the ANX CASP Applicant/ parent has been in business. If under different names, the ANX CASP Applicant **shall** indicate former names. The ANX CASP Applicant **shall** represent that it has been in business for at least three years.

[R2-4.: CertApp]   Employees

R   The ANX CASP Applicant **shall** indicate number of employees by function, and **shall** describe the function of employees anticipated to provide the Certificate Authority Service. The ANX CASP Applicant **shall** describe its commitment to providing these staffing levels described.

[R2-5.: CertApp]   Products and Services

R   The ANX CASP Applicant **shall** describe its primary products.

[R2-6.: CertApp]   Management Experience

R   The ANX CASP Applicant **shall** provide information on its management team's experience in running ANX CASP Applicant or similar businesses:

  •   The ANX CASP Applicant **shall** describe background and experience of its primary and

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backup contacts and attach their biography data.

[R2-7.: CertApp]   Technical Experience

R The ANX CASP Applicant **shall** indicate number of years of CA Service operations/security and other related technical experience of its technical staff.

[R2-8.: CertApp]   Commitment to Providing Certificate Authority Service

R The ANX CASP Applicant **shall** comply with all of the following:

1.   The ANX CASP Applicant **shall** demonstrate the extent to which financial and other resources are being committed by the parent company or principal(s) to the entity that will be providing the Certificate Authority Service

2.   In the event of any mergers and acquisitions or any corporate restructuring, the ANX Applicant **shall** represent that there will be no impact on providing Certificate Authority Service.

[R2-9.: CertApp]   Future Business Plans

R The ANX CASP Applicant **shall** provide forward-looking information as described below, unless it is demonstrated that the ANX CASP Applicant and its customers will have recourse to funding and resources of the ANX CASP Applicant's parent organization, and if the ANX CASP Applicant's parent organization has a Moody's (or equivalent) corporate credit rating of "A" and above:

1.   The ANX CASP Applicant **shall** provide information on its near-term business plans (current fiscal year) and longer-term business plans (two (2) fiscal years after current fiscal year) and **shall** provide all necessary documentation. Provided business plans **shall** include, but **shall** not be limited to, information on:

a)   target markets,

b)   service and product offerings planned,

c)   expected revenues and growth rates,

d)   distribution channels for company's products and services,

e)   action plans to achieve objectives, and

f)   funding plans

2.   In case of funding from another organization, the ANX CASP Applicant **shall** indicate relationship of the funding organization to the ANX CASP Applicant, and the funding

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organization's main line of business, its last FY revenues, net income, cash flow from operating activities and free cash flow (defined in the following financial metrics requirements).

[R2-10.: CertApp]   Legal Metrics

Potential conflicts of interest in operating as an ANX CASP

R ANX CASP Applicant **shall** attach letter from Applicant's Counsel indicating that it does not have any and does not anticipate any conflicts of interest.

Pending litigation

R ANX CASP Applicant **shall** attach letter from Applicant's Counsel indicating that it does not have any pending litigation that could impact applicant's ability to serve as a reputable ANX Certificate Authority Service Provider.

[R2-11.: CertApp]   Insurance Metrics

Liability insurance coverage

R ANX CASP Applicant **shall** list its insurance carrier, and **shall** indicate its coverages and limitations.

[R2-12.: CertApp]   Trigger

R If, after receiving ANX Certification, the ANX CASP Applicant fails to meet required financial criteria (including credit rating), it **shall** notify ANXO immediately. In addition, ANX CASP **shall** inform the ANXO of its plans to remedy the situation, and **shall** inform the ANXO on its progress every quarter until it meets the required financial criteria again.

[R2-13.: CertApp]   Format of All Submitted Documentation

R The ANX CASP Applicant **shall** provide ANXO ANX Certification Application documentation in hard copy or in PDF format, on 3.5" floppy or Iomega-compatible zip drive.

An Applicant for certification that fails to conform in a de-minimus manner to one or more of the criteria set forth in this ANX Certification Application Requirements section may demonstrate to the ANXO why it would nonetheless be able to provide a consistent quality of Certificate Authority Service.

2.2   ANX Certification Assessm nt Proc ss for CASPs

After all requirements for ANX Certification Application for CASPs have been met the requirements for ANX Certification Assessment for CASPs must be met.

After all ANX Certification Assessment requirements for CASPs have been met, or at latest after 120 business days after the ANX Certification Assessment process started for the ANX CASP Applicant, the ANXO sends the ANX CASP Applicant an ANX Certification Final Assessment Report for CASPs summarizing the ANXO's assessment for this ANX CASP Applicant.

If the CASP passed all requirements for ANX Certification Assessment for CASPs then the CASP pays the first monthly ANX Certification Verification fee for CASPs. Upon receipt of this fee the ANXO mails the CASP a certificate signifying that the CASP has become an ANX CASP.

3. Requirements for ANX Certification Assessment and Verification for ANX CASP

3.1 General ANX CASP Certification Assessment and Verification Requirements

An ANX CASP serves an important role in the ANX Network. It acts as a point of trust within the network. The procedures, policies and practices that an ANX CASP will support in order to maintain this trust must be understood by the ANX Trading Partners. In addition, the responsibilities of the ANX Subscribed Trading Partners in support of this trust must also be outlined. Finally, the uses to which this trust can be applied must also be defined. These topics are covered in a document that is referred to as a Certificate Practice Statement (CPS). This document must be published and available to ANX Subscribed Trading Partners so they can understand the function that ANX CASPs are providing within the ANX Network. If an ANX Subscribed TP relinquish their ANX Subscribed TP status all ANX Certificates issued by all ANX CASPs to that ANX Subscribed TP must be revoked. Additionally, certificates can be revoked for various other reasons, including ANX TP private key compromise or ANX CASP root key compromise. Therefore, ANX Certificate revocation requests must be supported by an ANX CASP from any holder of an ANX Certificate, the ANXO, or from within the ANX CASP. Further details about certificate issuance, renewal and revocation can be found in the ANX Certificate Policy and the ANX CASP CPS.

[R3-1.: CertAssVer] ANX Certificate Policy Compliance

R   CASPs **shall** comply with the ANX Certificate Policy [Part 6, Ref #32].

Measurement Technique:

R   CASPs **shall** submit evidence of compliance to the ANXO as required by the ANX Certificate Policy prior to certification and annually thereafter.

[R3-2.: CertAssVer] ANX Certificate Revocation

R   ANX CASPs **shall** revoke ANX Certificates issued to an ANX Trading Partner if the ANXO communicates to the ANX CASP that the ANX Trading Partner has lost ANX Trading Partner status.

Measurement Technique:

R   ANX CASPs **shall** prior to certification and annually thereafter submit a written statement indicating that ANX Certificates **shall** be revoked if an ANX Trading Partner loses their ANX status.

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[R3-3.: CertAssVer] Use of ANX Certificates

R   ANX CASPs **shall** issue ANX Certificates:

a)   To ANX Participants only, and

b)   For IPSec only, and

c)   for IP addresses assigned to that ANX Subscribed TP by their ANX CSP and authorized by the ANXO only, and

d)   For use on ANX interfaces only.

Measurement Technique:

R   ANX CASPs **shall** submit prior to certification and annually thereafter a written commitment to comply with this metric.

3.2   ANX Connectivity

[R3-4.: CertAssVer] Secure ANXO Communication

R   CASPs **shall** demonstrate secure ANXO communications over an ANX connection.

Measurement Technique:

R   CASPs **shall** prior to certification deploy and successfully test a system that will allow cryptographically authenticated and encrypted electronic communications between the ANXO and the CASP over the ANX Network. The ANX CASP Applicant **shall** work with the ANXO to get connectivity to the ANX for this purpose. ANX CASPs **shall** provide quarterly a statement of compliance that the system continues to work.

3.3   ANX Certificate Manufacturing Authority

An ANX CMA will issue ANX Subscribed Trading Partners ANX Certificates. There may be multiple ANX CASPs within the ANX Network. Therefore, ANX CMAs must support the bridging of trust with other ANX CASPs within the ANX. This bridging of trust should allow ANX Certificates issued by one ANX CASPs to be trusted by ANX Subscribed Trading Partners that subscribe to another ANX CASP.

[R3-5.: CertAssVer] Inter-ANX CASP Bridging of Trust

R   ANX CASPs **shall** support bridging of trust with other ANX CASPs.

Measurement Technique:

R CASPs **shall** submit prior to certification and annually thereafter a written commitment to comply with this metric.

3.4 ANX Registration Authority

An ANX RA function authenticates requests by TPs for an ANX Certificate. An ANX RA also authorizes an ANX Certificate to be issued by a CASP. Because ANX Certificates should only be issued to and used by ANX Subscribed TPs, an ANX RA function must utilize the ANXO Directory for information regarding the state of an entity in the ANX.

The ANX Certificate issuance process will be as follows:

1. ANX TP requests an ANX Certificate from the ANX RA.

2. The ANX RA either denies the request or verifies the state of the ANX Trading Partner and their network information with the ANXO.

3. If this information is verified, the RA securely authorizes a certificate to be issued by the ANX CMA and returns ANX Certificate retrieval information securely to the ANX TP.

4. The ANX CMA issues an ANX Certificate to the ANX TP when required.

3.5 ANX Repository

An ANX Repository is a publicly accessible site that contains copies of the ANX Certificates issued by an ANX CASP. It also contains ANX Certificate Revocation Lists (ANX CRL), which list certificates that have been revoked by an ANX CASP. For more information on CRLs, see [Part 6, Ref #31].

The protocol used by both IPSec and other applications to access repositories is the Lightweight Directory Access Protocol (LDAP). It is therefore necessary that the certificate Repository support this protocol.

[R3-6.: CertAssVer] LDAP Support

R An ANX CASP **shall** support the publishing of ANX Certificates and ANX CRLs in an ANX accessible Repository with an LDAP version 2 compliant interface.

Measurement Technique:

R CASPs **shall** submit prior to certification and annually thereafter a written commitment to comply with this metric.

[R3-7.: CertAssVer] Certificate Practice Statement

R An ANX CASP **shall** make a Certificate Practice Statement for ANX Certificates publicly available. This Certificate Practice Statement **shall** be compatible with, and not conflict with, the ANX Certificate Policy.

Measurement Technique:

R ANX CASPs **shall** submit a CPS to the ANXO prior to certification and quarterly thereafter or when changes occur and **shall** publish that CPS in a public manner (e.g., on the ANX CASP web site).

3.6   ANX Repository Reliability

The availability of the CASP Repository must be significantly higher than the availability of the network so that network performance is not effected. This can be achieved by having two geographically dispersed servers with diverse routing. If the servers and the leased lines to those servers both have availability of 99.5%, then the overall service availability (assuming independence of the availability) will be 99.99%.

[R3-8.: CertAssVer] Repository Design

R An ANX CASP's Repository Service **shall** be designed as a robust service.

Measurement Technique:

R ANX CASPs **shall** submit an adequate written Repository service design prior to certification and annually thereafter or when changes occur.

[R3-9.: CertAssVer] Repository Reliability

R An ANX CASP's Repository Service **shall** have an availability of 99.99% (all but 0.87 hours per year).

Measurement Technique:

R ANX CASPs **shall** commit to meeting this metric prior to certification and thereafter calculate and quarterly report to the ANXO the availability of the ANX CASP's Repository Service (for calculation methods of Availability see [Part 6, Ref #2 Section 5]).

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3.7 Interoperability, S curity and Busin ss Continuity and Disaster Recovery Plan

[R3-10.: CertAssVer] Interoperability, Security and BC/DRP

R ANX CASPs **shall** support the requirements for these areas as specified in the ANX Certificate Policy.

Measurement Technique:

R ANX CASPs **shall** provide evidence of compliance with the ANX Certificate Policy as stipulated in the ANX Certificate Policy. This evidence **shall** be supplied prior to certification and annually thereafter or when either the CASPs CPS or the ANX CP changes.

3.8 Trouble Handling

[R3-11.: CertAssVer] Trouble Handling Systems and Trouble Reporting / Trouble Report Acceptance

R ANX CASPs **shall** operate trouble handling systems and **shall** confirm to the following trouble reporting/trouble report acceptance requirements that specifically relate to them:

1. ANX CASPs **shall** accept trouble reports related to ANX Subscribed TPs who are their customers.

2. ANX CASPs **shall** accept trouble reports from other ANX CASPs, ANX CEPOs or from the ANXO.

Measurement Technique:

R ANX CASPs **shall** provide ANXO proof of operational trouble handling systems, and **shall** commit to comply with trouble reporting and trouble report acceptance requirements stated above. The evidence **shall** be provided before certification and quarterly thereafter.

[R3-12.: CertAssVer] Trouble Help Desk Scheduled Service Time

The Trouble Help Desk Scheduled Service Time is the time that the Trouble Help Desk is planned to be offered. This parameter is measured in days per week and hours per day.

R ANX CASP **shall** commit that the Scheduled Service Time for the Trouble Help Desk **shall** be 24 hours per day, and 7 days per week by the time Certification Assessment is completed. Trouble Help Desk services are operated by ANX CASPs for ANX Subscribed TPs to whom they provide ANX services and for other service providers in the ANX.

Measurement Technique:

R CASPs **shall** provide the date when they will activate their 24*7 Trouble Help Desk Scheduled Service Time before certification. The start date for the 24*7 service **shall** be prior to certification assessment completion date. ANX CASPs **shall** restate their commitment to this metric quarterly.

[R3-13.: CertAssVer]   Trouble Help Desk Availability

Trouble Help Desk Availability is defined as the amount of time that the Trouble Help Desk is available via phone and not busy (busy is defined as a caller having to wait at least 2 minutes between menu selection and being connected to a real person (when the services of a help desk operator is requested)). The Availability is expressed as a percentage of the total scheduled time that includes outages and repairs.

R The Trouble Help Desk Availability **shall** be at least 99.95%, corresponding to a total unavailability of no more than 4.38 hours per year.

Measurement Technique:

R ANX CASP **shall** commit to comply with Trouble Help Desk Availability requirements stated above, prior to certification. Thereafter, the ANX CASP **shall** calculate and report quarterly on the actual availability.

[R3-14.: CertAssVer]   Trouble Isolation

ANX CASPs are required to collaborate with other ANX service providers, the ANXO and ANX Subscribed TPs for the purpose of trouble isolation.

R ANX CASPs **shall** be required to collaborate with CSPs, ANX CEPOs and ANXO, TPs in trouble isolation. Especially, ANX CASPs **shall** be able to determine:

a. CASP out of service

b. CASP unreachable

c. ANX RA-ANX CMA loss of connectivity

d. ANX Certificate state for a TP/IP address:

    i)   None issued

    ii)   Current

    iii)   Revoked

iv)   Expired

Measurement Technique:

R   ANX CASPs **shall** provide the ANXO with a written procedure for handling the stated trouble types. This **shall** be provided before certification and quarterly or when changes occur thereafter.

[R3-15.: CertAssVer]   Trouble Escalation Policy

R   ANX CASPs **shall** have an adequate Trouble Handling and Escalation Policy prior to certification.

Measurement Technique:

R   ANX CASPs **shall** submit a written Trouble Handling and Escalation Policy prior to certification and quarterly or when changes occur thereafter. The ANXO will verify the adequacy of this policy. An adequate policy **shall** at least contain the following:

1. Responsibilities or titles of the staff in the escalation chain and general contact information at all levels involved **shall** be specified;

2. Conditions for escalations **shall** be specified;

3. The policy **shall** correlate the escalation level with the outage interval; and

4. The policy regarding required vendor interactions (including vendor contact information or how this information is obtained) **shall** be correlated with the trouble escalation process of the service provider.

[R3-16.: CertAssVer]   Outage Notification Bulletin Board

R   ANX CASPs **shall** participate in the Inter-ANX CSP and ANX CEPO Outage Notification electronic bulletin board as defined in [Part 6, Ref #2 section 5].

Measurement Technique:

R   ANX CASPs **shall** commit prior to certification to notify outages using ANXO-hosted electronic bulletin board program and test the interface prior to certification. ANX CASPs **shall** restate the commitment quarterly after certification. See [Part 6, Ref #2 Section 5] for details on reportable outages and notification specifics.

3.9   Summary of CASP ANX Certification and Verification Metrics Requirements

Table 3-1 summarizes requirements on CASP ANX Certification Assessment and Verification Metrics.

Section Number	Reference Number	Metric / Requirement	Criterion	ANX Certification Assessment	ANX Certification Verification	Reporting Format Assessment/ Verification
3-	1	ANX Certificate Policy Compliance	Compliance	Yes	Annually	PDF
3-	2	ANX Certificate Revocation	Compliance	Yes	Annually	PDF
3-	3	Use of ANX Certificates	Compliance	Yes	Annually	PDF
3-	4	Secure ANXO Communication	Compliance	Yes	Quarterly	PDF
3-	5	Inter-ANX CASP Bridging of Trust	Compliance	Yes	Annually	PDF
3-	6	LDAP Support	Compliance	Yes	Annually	PDF
3-	7	Certificate Practice Statement	Compliance	Yes	Annually, or when changes occur	PDF
3-	8	Repository Design	Design	Yes	Annually or when changes occur	PDF
3-	9	Repository Reliability	≥99.99%	Yes	Quarterly	PDF
3-	10	Interoperability, Security and BC/DRP	Compliance	Yes	Annually or when changes occur	PDF
3-	11	Trouble Handling Systems and Trouble Reporting/Trouble Report Acceptance	Compliance	Yes	Quarterly	PDF
3-	12	Trouble Help Desk Scheduled Service Time	24 hours / day, 7 days / week	Yes	Quarterly	PDF / Excel (using template Q-THM.XLS)
3-	13	Trouble Help Desk Availability	≥ 99.95 %	Yes	Quarterly	PDF / Excel (using template Q-THM.XLS)
3-	14	Trouble Isolation	Compliance	Yes	Quarterly or when changes occur	PDF
3-	15	Trouble Escalation Policy	Compliance	Yes	Quarterly or when changes occur	PDF
3-	16	Outage Notification Bulletin Board	Compliance and Testing	Yes	Quarterly	PDF

Table 3-1: CASP ANX Certification Assessment and Verification Requirements Summary

4. ANX Trouble Handling, ANX Certification Revocation, and ANX Re-Certification for ANX CASPs

When an ANX CASP fails to meet one or more requirements for ANX Certification Verification for CASPs then ANX Trouble Handling will commence in the same way as applies for ANX CSPs, as set forth in greater detail in [Part 6, Ref #1]. Furthermore, procedures defined for ANX Certification Revocation and ANX Certification Re-Certification as defined for ANX CSPs [Part 6, Ref #1] apply to ANX CASPs as well.

5. Appendix A

5.1 Introduction

In the Automotive Network eXchange (ANX), Trading Partners will exchange sensitive data and there is a need for security assurances regarding this data. These requirements are identified in the Trading Partner Current State Assessment document.

The original design of the Internet Protocol (IP) did not anticipate its use as a general-purpose protocol for sensitive business transactions. Therefore, the IP design did not take into account the need for encrypting or authenticating any information. Generally speaking, current users of the Internet lack any assurance of confidentiality, authenticity, or data integrity.

To handle data confidentiality, authenticity, and integrity issues, numerous protocols are being developed; most of which make use of public-key cryptography. The Internet Engineering Task Force (IETF) has defined the Internet Protocol Security (IPSec) architecture for network-layer encryption. Most implementations of IPSec rely on some form of public-key cryptography for the distribution of long-term keys (short-term keying is generally based on symmetric key cryptographic algorithms, due to their greater relative speed). For readers unfamiliar with the concepts of cryptographic systems, the fundamentals of public-key cryptography are discussed below.

Fundamental to the use of public-key cryptography is an assurance that one party has the other party's legitimate key, and can guarantee communications with the correct person. This assurance is provided through the use of individual "certificates", which bind the identity of a user (human or machine) to a given public-key. These certificates are essential to the functionality of a system based on public-keys where one human user or system needs to know without a doubt the identity of the other communicating party. Certificates are generally exchanged prior to a transaction protected using public-key systems, and applications extract keys after verifying the certificate's authenticity. Certificates are discussed in more detail below.

Many applications, including web browsers and servers, electronic mail applications, and network-level encryption (such as the IPSec architecture) support the use of certificates for authenticating keys to secure communications in transit. It is expected that these applications, as they are used on the ANX, will employ the public-key infrastructure described in this document for encryption and authentication services. Furthermore, the proposed IPSec infrastructure of the ANX will require the use of certificates to distribute public-keys that are then, in turn, used for key exchange for network-level encryption.

5.2   Cryptographic Basics

There is a set of security services that is generally employed to address the threats to systems, applications, and information. Generally, these services include confidentiality, authenticity, data integrity, and non-repudiation, and are provided through the use of cryptography. This section is a brief tutorial on the fundamentals of cryptography. It is designed to introduce the concepts and terminology used throughout this document. Readers already familiar with the basics of cryptographic technology and terminology may choose to skim through this section.

Using cryptography in distributed communications, users can enjoy confidentiality, integrity, authenticity, and non-repudiation of message origin and content. Briefly, confidentiality protects transmitted messages from unauthorized disclosure and data integrity ensures that the message content is not modified during transmission. Authenticity is simply the assurance that the remote entity sending the message is correctly identified. Non-repudiation of message origin and content protects against the sender denying transmission of the message and its content.

In cryptography, the term encryption refers to the transformation of a readable cleartext message into an incomprehensible message called a ciphertext. The original text can be recovered through the dual operation of decryption. Conventionally, two parties wishing to communicate securely would share a secret key and use a symmetric cryptosystem such as the Data Encryption Standard (DES) to encrypt messages being exchanged. The sender of a message encrypts using the same key that the recipient of the message uses to decrypt the ciphertext, hence the phrase symmetric key cryptography. No eavesdropping intruder is able to understand the conversation without the knowledge of the shared secret key.

The major drawback to this approach is that the two communicating parties have to exchange the common secret key in a secure fashion prior to the actual communication. This exchange usually takes place using an out-of-band mechanism. In addition, each user has to have a way of getting a separate key for each other user with whom she or he wishes to communicate.

Alternatively, an approach to key distribution is asymmetric cryptography. In asymmetric cryptography, instead of one common key, a pair of keys is generated for each user. One is called the private-key and is known only to the user. The other is called the public-key and should be known by everyone else wishing to communicate securely with that user. Because the public-key is publicized for all users, asymmetric cryptography is also called public-key cryptography.

To send a confidential message, the sender encrypts the message using the recipient's public-key. Only the recipient who possesses the private-key can then decrypt the received ciphertext to retrieve the original message. Using the private-key, a user can create a digitally signed message. Since this user is the only person knowing that key, the signed message could only have been generated by this user. The original message can be retrieved and the signature verified by decrypting the signed message with the public key of the signer.

There is a performance delay cost associated with signing the message. This cost increases with the length of the message. In most cases, it may be more practical to first obtain a message digest by running the message through a one-way hashing algorithm and then signing the digest instead. The digest is a fixed length checksum, usually much smaller than the original message itself. If this approach is taken, the signature can be verified by recalculating the message digest and comparing the result with the decrypted signature. Digital signatures provide support for authenticity, data integrity, and non-repudiation of message origin and content. The capability to digitally sign messages is one of the advantages of asymmetric cryptosystems over symmetric cryptosystems. One of the earliest asymmetric cryptosystems was presented by Rivest, Shamir, and Adleman in 1978.

5.3   Why Certificates are Needed

Since the public-key of every user is (by definition) widely available, it is therefore vulnerable to unauthorized modification. How can users be assured that the published public-key for any given individual is, in fact, true and accurate, and has not been tampered with or altered in any way? One approach adopted by the industry to address this problem is the use of digital certificates. The certificate is a digital message which contains both the user's identity and the user's public-key. Thus, the certificate acts to bind a user's identity to their public-key.

Digital certificates are digitally signed, or "issued," by trusted agents called Certificate Authorities (CAs). By signing the public-key of an entity, a CA is stating that the identity of the certificate holder is described correctly by the contents of the certificate. Therefore, entities that trust the CA can also trust that the identity reported in the certificate is true. The issuance of these certificates is one of the primary roles of a CASP.

5.4   How Certificates are used in IPSec

Anatomy of an IPSec connection
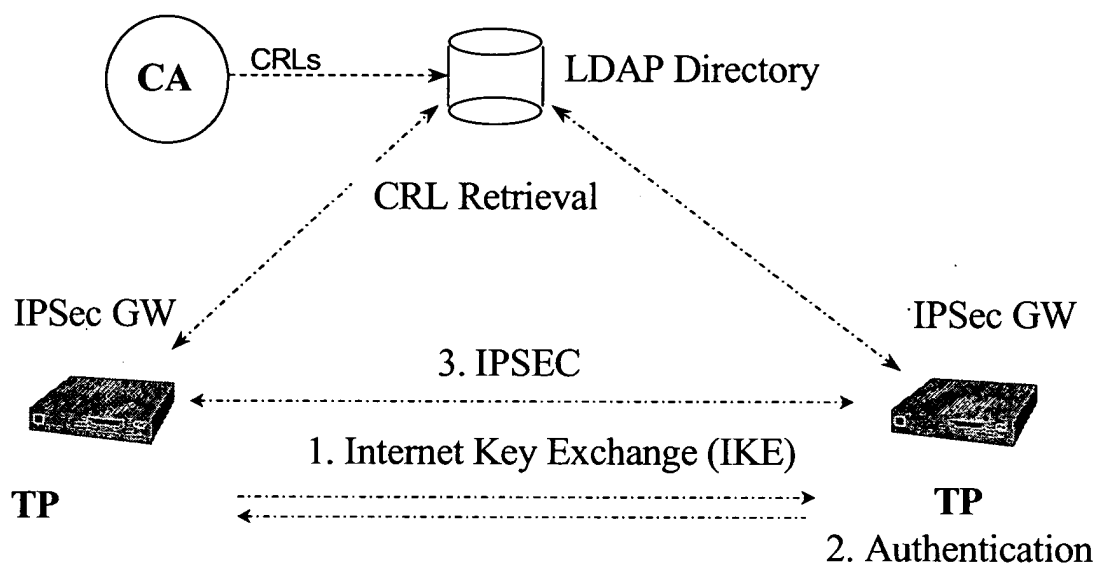
After certificates are issued to both IPSec Gateways, an IPSec session can take place. First, the CA must publish the Certificate Revocation List (CRL) that contains all revoked certificates to the Repository, implemented with an LDAP directory. After that:

1. The IPSec GWs exchange credentials (ANX Certificates) and other IPSec information using IKE.

2. The IPSec GWs must authenticate each others credentials. This requires that the CRL be retrieved from the LDAP directory.

3. Once authentication of the partner credentials is complete and the IPSec parameters are negotiated, an IPSec tunnel can be completed.

This is an overview of the complete process for a simple IPSec connection using certificates.

PART 6

ANX Trademarks, Glossary, and References

TEL-2 02.00, 5/1998

Part 6 - ANX Trademarks, Glossary, and References

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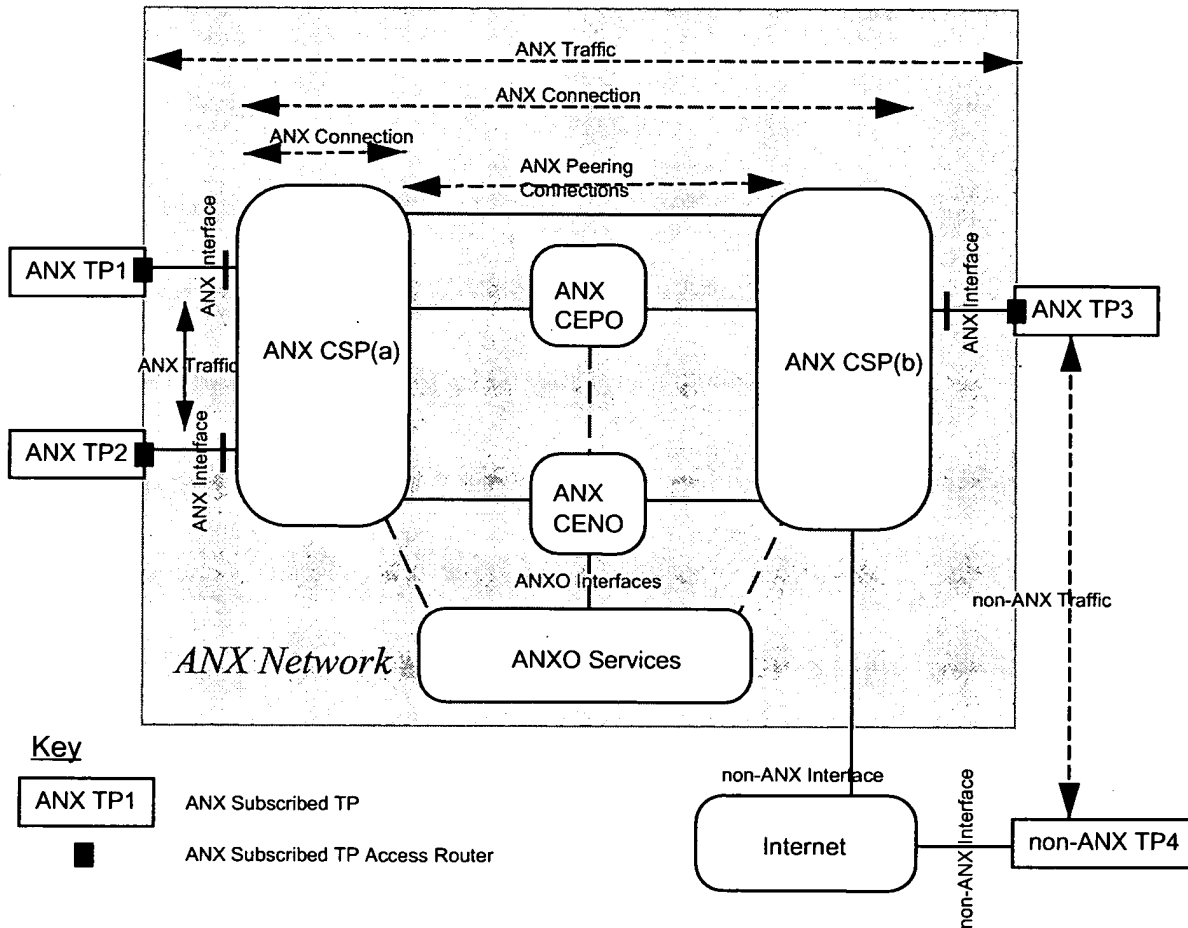# 1. Trademarks, Registered Trademarks, and Service Marks

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2. Glossary

Some of the terms and abbreviations described in the Glossary are demonstrated in Figure 2-1.

Figure 2-1. Glossary Terms

Term	Definition
AIAG	Automotive Industry Action Group
ANX	Automotive Network eXchange
ANX CA	See ANX Certificate Authority
ANX CASP	See ANX Certificate Authority Service Provider
ANX CEN	See ANX Certified Exchange Network
ANX CENO	See ANX Certified Exchange Network Operator
ANX CEP	See ANX Certified Exchange Point
ANX CEPO	See ANX Certified Exchange Point Operator
ANX Certificate	A certificate with all of the following characteristics: • Issued by an authorized ANX Certificate Authority (CA) as an ANX Certificate • Issued under the ANX Certificate Policy
ANX Certificate Authority (CA)	An entity authorized to issue ANX Certificates
ANX Certificate Authority Service Provider	A Service Provider authorized to operate an ANX CA
ANX Certificate Policy	The public ANX policy that governs the use and management of ANX Certificates and that is published by the AIAG
ANX Certificate Practice Statement	A public document expressing the policy and practices of an ANX CASP with respect to ANX Certificates
ANX Certification Application	The process of payment of the ANX Certification Application fee, submission of the required information and the ANXO's undertaking of the ANX Certification Application Analysis, all as set forth in greater detail in [Part 6, Ref #1]

ANX Certification Application Analysis	The part of the ANX Certification Application process whereby the ANXO analyzes the ANX Certification Application, as set forth in greater detail in [Part 6, Ref #1]
ANX Certification Application Criteria	The ANX Certification Application Criteria, as set forth in greater detail in [Part 6, Ref #2]
ANX Certification Application Report	The ANXO written summary to an ISP or EPO of the outcome of the ANX Certification Application Services
ANX Certification Application Services	The ANXO Services set forth in [Part 6, Ref #4] that determine whether or not an ISP Network or EP has fully complied with the ANX Certification Application Criteria set forth in [Part 6, Ref #2]
ANX Certification Assessment Analysis	The process undertaken by the ANXO of analyzing the ANX Certification Assessment Criteria, as set forth in greater detail in [Part 6, Ref #1]
ANX Certification Assessment Criteria	The criteria used in ANX Certification Assessment process, as set forth in greater detail in [Part 6, Ref #2]
ANX Certification Assessment Report	The ANXO written summary to an ISP or EPO of the outcome of the ANX Certification Assessment Services, as set forth in greater detail in [Part 6, Ref #1]
ANX Certification Assessment Services	The ANXO Services set forth in [Part 6, Ref #4] that determine whether or not an ISP Network or EP has fully complied with the ANX Certification Assessment Criteria set forth in [Part 6, Ref #2]
ANX Certification Certificate	The certificate issued to certify that an ISP s or EPO s network has met the ANX Certification Assessment Criteria for North America, as set forth in greater detail in [Part 6, Ref #1 and #2]
ANX Certification Criteria	Collectively, the ANX Certification Application Criteria, ANX Certification Assessment Criteria, and ANX Certification Verification Criteria, all as set forth in greater detail in [Part 6, Ref #1 and 2]
ANX Certification Probation Timer	The period of time set for the probation period, as set forth in greater detail in [Part 6, Ref #1]
ANX Certification Report	Any one of the ANX Registration Report, ANX Certification Application Report, ANX Certification Assessment Report, ANX Certification Verification Report for an ISP or EPO
ANX Certification Revocation Timer	The period of time set for the revocation period, as set forth in greater detail in [Part 6, Ref #1]

ANX Certification Revoked	The revoked state of an ISP or EPO as listed on the ANXO Directory listing, as set forth in greater detail in [Part 6, Ref #1]
ANX Certification Services	The ANX Network certification services provided generally by the ANXO to ISPs, EPOs, and TPs, all as set forth in [Part 6, Ref #4]
ANX Certification States	The various certification states an ISP or EPO can be in during the ANX Certification process, as set forth in greater detail in [Part 6, Ref #1]
ANX Certification Verification Criteria	The ANX Certification Verification Criteria, as set forth in greater detail in [Part 6, Ref #2]
ANX Certification Verification Reports	The ANXO written summary to an ISP, EPO, or TP of the outcome of the ANX Certification Verification Services
ANX Certification Verification Services	The ANXO Services set forth in [Part 6, Ref #4] that determine whether or not an ISP Network or EP has fully complied with ANX Certification Verification Criteria set forth in [Part 6, Ref #2]
ANX Certification Verification Timers	The time period set for ANX Certification Verification, as set forth in greater detail in [Part 6, Ref #1]
ANX Certified	The state of an ISP Network or EP that has fully complied with the requirements to begin ANX Certification Verification Services
ANX Certified Exchange Network (ANX CEN)	A network of interconnected ATM switches used in the ANX as an Exchange Network whose provider is ANX Certified
ANX Certified Exchange Network Operator (ANX CENO)	An ENO listed in the ANXO Directory with their state listed as ANX Certified
ANX Certified Exchange Point (ANX CEP)	An ATM switch used in the ANX as an Exchange Point whose provider is ANX Certified
ANX Certified Exchange Point Operator (ANX CEPO)	An EPO listed in the ANXO Directory with their state listed as ANX Certified
ANX Certified Service Provider (ANX CSP)	An ANX Registered ISP listed in the ANXO Directory with their state listed as ANX Certified
ANX Connection	A physical or logical connection linking ANX Interfaces or linking an ANX Interface with an ANX Peering Connection
ANX CSP	See ANX Certified Service Provider

ANX Document	The *ANX Release 1 Document Publication, AIAG TEL-2, Revision 1,* issued by the Automotive Industry Action Group ("AIAG"), and any corrections to such document as may be posted on the ANXO Website, and future published revisions, all as agreed to by ANXO and AIAG
ANX Interface	A physical or logical interface with all of the following characteristics:

- Interface between an ANX Subscribed TP and an ANX CSP

- Subject to criteria in [Part 6, Ref #2]

ANX IPSec Gateway	A function with all of the following characteristics:

- Located at the premises of ANX Subscribed TPs

- Executes IPSec

- Uses ANX Certificates

ANX Network	A communications network described in greater detail in the Document
ANX Network Service	The network service described in the ANX Document with all of the following characteristics:

- Connects ANX Subscribed TPs only

- Carries ANX Traffic only

- Carries ANX Traffic on ANX Connections only

- Provided by ANX Certified Service Providers only

- Subject to ANX Certification process

- Exclusive use of ANX Certificates

Excluded from the ANX Network Service are:

- Connections to non-ANX Registered TPs

- Routes carrying non-ANX Traffic

- Non-ANX Connections

- Non-ANX Certified Service Providers

- Network facilities and routes not subject to the ANX Certification process

ANX Overseer (ANXO)	An independent entity commissioned by the AIAG to provide services defined in [Part 6, Ref #4]
ANX Participant	Any entity contracted for ANXO Services, as set forth in greater detail in [Part 6, Ref #4]
ANX Peering	Procedures that ANX CSPs must use to be able to exchange ANX Traffic between CSPs, as set forth in greater detail in [Part 6, Ref #2]
ANX Peering Connection	A portion of an ANX Connection with either of the following characteristics:

- A bilateral ANX CSP-ANX CSP connection

- An ANX CSP-ANX CSP connection through an ANX CEPO

ANX RA	See ANX Registration Authority
ANX Re-Certification	The process of Re-Certification, as set forth in greater detail in [Part 6, Ref #1]
ANX Re-Certification Timer	The period of time set for the Re-Certification period, as set forth in greater detail in [Part 6, Ref #1]
ANX Registered EPO	An EPO listed in the ANXO Directory <u>and</u> with their state listed as ANX Registered
ANX Registered ISP	An ANX Registered ISP listed in the ANXO Directory <u>and</u> with their state listed as ANX Registered
ANX Registered TP	An ANX TP listed in the ANX Registration Directory, <u>and</u> with their state listed as ANX Registered
ANX Registration	The registration undertaken by TPs, ISPs, and EPOs for ANXO Services, as set forth in greater detail in [Part 6, Ref #1 and #3]
ANX Registration Authority (ANX RA)	Function that authenticates and authorizes ANX Subscribed TPs to receive ANX Certificates
ANX Registration Form	The form used for ANX Registration, as set forth in [Part 6, Ref #1]
ANX Registration Report	The ANXO written summary to an ISP, EPO, or TP of the outcome of the ANX Registration Services
ANX Registration Services	The ANXO Services set forth in [Part 6, Ref #4] that determine whether or not an ISP, EPO, or TP has fully complied with the ANX Registration requirements set forth in [Part 6, Ref #1]

ANX Route	Network layer reachability information for an ANX Subscribed TP (connectivity with the public Internet or non-ANX destinations is excluded; the rules for ANX Routes and non-ANX Routes and their cohabitation are defined in [Part 6, Ref #2])
ANX Route Server (RS)	A server with all of the following characteristics: • Advertises ANX Routes in the ANX Routing Registry to all ANX CSPs • Uses BGP-4 to peer with the ANX CSPs
ANX Route Service	A service provided by the combination of the ANX Routing Registry and the ANX Route Server
ANX Routing Registry (RR)	A database listing all valid routes for TPs, ISPs, and EPOs, as set forth in greater detail in [Part 6, Ref #1 and #2], and with all of the following characteristics: • Lists all ANX Routes • Lists mappings between ANX CSPs and ANX Subscribed TPs • Accepts ANX Route updates from ANX CSPs • Makes ANX Routes available to the ANX Route Server • Excludes non-ANX Routes
ANX RR	See ANX Routing Registry

ANX Subscribed TP	An ANX TP listed in the ANXO Directory, <u>and</u> with their state listed as ANX Subscribed
ANX Subscribed TP Access Router	A router with all of the following characteristics • Located at the premises of an ANX Subscribed TP • Connects to the ANX Network through an ANX Interface • Managed and maintained by the ANX CSP to which the ANX Subscribed TP is subscribed
ANX Subscription Form	The form used for ANX Subscription, as set forth in [Part 6, Ref #1]
ANX Subscription Report	The ANXO written summary to a TP of the outcome of the ANX Subscription Services
ANX Subscription Services	The ANXO Services set forth in [Part 6, Ref #4] that determine whether or not a TP has fully complied with the ANX Subscription requirements set forth in [Part 6, Ref #3]
ANX TP	See ANX Trading Partner
ANX Trading Partner (ANX TP)	Any Trading Partner that has a current signed ANXO Contract
ANX Traffic	Traffic between ANX Subscribed TPs which are connected to ANX Certified Service Provider(s). Traffic between an ANX Subscribed TP and an Internet host is permitted in the ANX Network, but is not considered ANX Traffic as exactly described in [Part 6, Ref #2, Section 3])
ANXO	See ANX Overseer
ANXO Contract for Service Provider Fee Schedule	Fee schedule included in ANXO Service Provisioning Package for Service Providers
ANXO Contract for Trading Partner Fee Schedule	Fee schedule included in ANXO Service Provisioning Package for Trading Partners
ANXO Contract Number	A unique number assigned by the ANXO to an ANXO Contract
ANXO Directory	A database with content as defined in [Part 6, Ref #1, #3 and #5]
ANXO Interface	An ANXO physical or logical interface described in [Part 6, Ref #2]

ANXO OC	See ANXO Operations Center
ANXO Operations Center (ANXO OC)	An Operations Center that is used by the ANXO in support of carrying out its services defined in [Part 6, Ref #4]
ANXO Report	Any report prepared by the ANXO
ANXO Service Provisioning Package for Service Providers	Package defined in [Part 6, Ref #1]
ANXO Service Provisioning Package for Trading Partners	Package defined in [Part 6, Ref #3]
ANXO Services	Services provided by the ANXO, as set forth in greater detail in [Part 6, Ref #4]
ANXO Trouble Handling	The trouble handling process, as set forth in greater detail in [Part 6, Ref #1]
ANXO Trouble Ticket	The record opened upon initiation of the ANXO Trouble Handling process, as set forth in greater detail in [Part 6, Ref #1, #2, and #4]
ANXO Website	Public ANXO website (www.anxo.com), or
	ANX Network-accessible website, accessible only by ANX Participants
ATM	Asynchronous Transfer Mode, a data link layer technology that transmits data in 53-byte cells
ATP Initialization	The initial ATPs are the ten company primary member representatives of the AIAG ANX Implementation Task Force (ANX ITF).
ATP Registered Agent	Each ATP shall assign a single agent registered with the ANX Overseer (ANXO) who has the authority to authorize a new trading partner.
Authorizing Trading Partner (ATP)	A Trading Partner authorized to sponsor new ANX Trading Partners.
BC/DRP	Business Continuity/Disaster Recovery Plan
CAD	Computer Aided Design
CERT	Carnegie Mellon's Computer Emergency Response Team
CIAC	Department of Energy's Computer Incident Advisory Capability

Confidential ANX Information	**Confidential ANX Information** means as between two parties to an ANXO service agreement, information of a party to such agreement which is provided or disclosed to the other and is marked as confidential or proprietary, and also includes any information concerning the performance of ISP/EPO under any of the ANX Certification Criteria or otherwise concerning the performance of ISP/EPO's network design and performance statistics, which may be gathered by or provided to the ANXO by ISP/EPO or third parties. If the information is initially disclosed orally then (1) it must be designated as confidential or proprietary at the time of the initial disclosure and (2) within 20 days after disclosure, the information must be reduced to writing and marked as confidential or proprietary. No information of the disclosing party will be considered Confidential ANX Information to the extent the information;

(i) is publicly known through no fault of the recipient either before or after disclosure; or

(ii) is in the possession of the recipient prior to the disclosure, or thereafter is independently developed by recipient's employees or consultants who have had no prior access to the information; or

(iii) is received from a third party without an obligation of confidence to the third party.

As part of its ANXO Services, ANXO will collect or create data, reports and other information related to ANX Participants that the ANX Participants may consider confidential. Confidential ANX Information shall be categorized and treated by the ANX Participants as follows:

(i) **Category 1 Confidential ANX Information**: ANXO may use this information as necessary to provide ANXO Services, but shall not disclose such information to any third party or to the AIAG; provided however, that if no successor ANXO has been appointed by AIAG upon the termination of expiration of the ANXO's agreement with the AIAG, such information may be placed in escrow at AIAG's sole expense and transmitted at the AIAG's direction to any successor ANXO, and provided further that such successor ANXO shall have entered into an agreement with confidentiality obligations at least as stringent as those contained herein. Nothing contained in this section shall require the ANXO to maintain or update such information once the ANXO's agreement with the AIAG terminates or expires, or once such information is placed in escrow.

(ii) **Category 2 Confidential ANX Information**: ANXO may provide

this information only to the party to which the information relates and/or to the Trading Partners or ISP/EPO, as the case may be, which has contracted directly with that party (for example, a report based on information provided by a Trading Partner and which relates to such Trading Partner's ISP/EPO could be disclosed to that ISP/EPO); provided however, that if no successor ANXO has been appointed by AIAG upon termination of expiration of this Agreement, such information may be placed in escrow and transmitted at the AIAG's direction to any successor ANXO, and provided further that such successor ANXO shall have entered into an agreement with confidentiality obligations at least as stringent as those contained herein. Nothing contained in this section shall require ANXO to maintain or update such information once the ANXO's agreement with the AIAG terminates or expires, or once such information is placed in escrow.

(iii) **Category 3 Confidential ANX Information**: ANXO shall provide this information only to the AIAG and to such other parties as the AIAG may designate.

(iv) **Category 4 Confidential ANX Information**: ANXO and the AIAG need not treat this information as confidential.

CPE	Customer Premises Equipment
Criterion	ANX Certification Criteria as set forth in greater detail in [Part 6, Ref #2]
DN	Distinguished Name
EDI	Electronic Data Interchange
EN	Exchange Network
ENO	Exchange Network Operator
EP	See Exchange Point
EPO	Exchange Point Operator
FAQ	Frequently Asked Questions
FDDI	Fiber Distributed Data Interface
FR	Frame Relay
HTTP	Hyper Text Transfer Protocol

ICMP	Internet Control Message Protocol
ICSA	International Computer Security Association, a for-profit entity currently responsible for IPSec conformance testing for ANX Releases. Only vendor products receiving third party (presently ICSA) IPSec certification may be used on the ANX.
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPSec	A security protocol defined in [Part 6, Ref #16-20, and 27-29] and associated documentation. See also [Part 6, Ref #3 and 5]
ISP	Internet (Protocol) Service Provider
LDAP	Lightweight Directory Access Protocol
MIB	Management Information Base
NAP	Network Access Point (Internet Exchange Point)
NE	Network Element
NOC	Network Operations Center
PEM	Privacy Enhanced Mail
PGP	Pretty Good Privacy
PKI	Public Key Infrastructure
PLR	Packet Loss Rate
Postal Mail Service	• Government postal mail service, or • Overnight mail service, or • Private paper mail delivery service
PPP	Point-to-Point Protocol
PVC	Permanent Virtual Circuit
· QOS	Quality of Service (or QoS)
R	Requirement (in the context of the ANX Document)

RFC	Request For Comments (terminology used for IETF-approved standards track or informational documents)
RS	See ANX Route Server
SMDS	Switched Multi-megabit Data Service
SNMP	Simple Network Management Protocol
SP	Service Provider
T1A1.2	The Network Survivability Performance Subcommittee of US Committee T1
TBD	To Be Determined
TCP	Transmission Control Protocol
Trading Partner (TP)	Any company with end-to-end business requirements with members of the automotive industry.
TTL	Time To Live

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